Overcoming obstacles for disaster prevention: Challenges and best practices from the EU and beyond (Deliverable 2.2)

Albris, Kristoffer; Lauta, Kristian Cedervall; Raju, Emmanuel

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Note about contributors

The following organisations contributed to the work described in this deliverable:

Lead partner responsible for the deliverable:

University of Huddersfield, UK

Dilanthi Amaratunga

WP leader responsible for the deliverable:

Dilanthi Amaratunga

Deliverable reviewed by:

Kevin Flemming (GFZ)

Authorized by:

Giulio Zuccaro (AMRA)

Other contributors:

Kristoffer Albris (UOC)

Nuwan Dias (UOD)

Richard Haigh (UOH)

Kristian Cedervall Lauta (UOC)

Emmanuel Raju (UOC)

ABSTRACT

This report is an analysis of the findings and insights drawn from six national reports, as well as a European Union (EU) and global report developed as part of the ESPREssO project ('Enhancing Synergies for Disaster Prevention in the European Union'). The analysis serves to highlight common themes and issues across EU countries, with relevant insights from the EU and global levels, concerning three central challenges for successful disaster management in the EU: (1) the integration between climate change adaptation (CCA) and disaster risk reduction (DRR); (2) bridging the gap between science and policy; and (3) strengthening transboundary crisis management in the EU. The purpose of the report is to provide input and insights into the final deliverables in the ESPREssO project.

Chapter 3 explores the obstacles and ways forward for the integration between climate change adaptation (CCA) and disaster risk reduction (DRR) in legislation, policies and institutional arrangements. The following issues were identified: weak horizontal and vertical coordination in CCA and DRR governance; lack of capacities of local governments for implementation of CCA and DRR strategies; resource limitations and poor implementation of strategies; lack of funding; political awareness and risk perception; inadequate platforms for stakeholder communication and engagement; unequal attention paid to CCA and DRR; and, conflicting priorities between disaster response and risk reduction.

Chapter 4 addresses the problems and potentials for bridging the gap between science and policy for DRR and CCA, in order to strengthen policy-making, the quality and availability of risk assessments, as well as public awareness of hazards, risks and vulnerabilities. The following issues were identified: inadequate platforms and structures for bringing science closer to policy, and the need to build platforms; demand for risk expertise in public institutions; a lack of available risk data on vulnerability; limited scope and outlook of research; low public awareness of disaster risks and climate change impacts; complex scientific terminology; and, new media landscapes.

Finally, Chapter 5 concerns the barriers and opportunities for strengthening transboundary crisis management in the EU, looking at existing agreements and arrangements between individual countries regionally, and at the EU level generally. The following issues were identified: isolated national thinking and lack of political will; absence of policies and tools for transboundary crisis management; lack of standardized forms of communication; international cooperation across national government levels; a lack of attention to CCA as a cross-border issue; and, conflicting priorities in environmental resources and DRR.

Keywords: disaster risk reduction, climate change adaptation, integration, science and policy, transboundary management

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Executive summary

This report is an analysis of the findings and insights drawn from six national reports, as well as a European Union (EU) and global report developed as part of the ESPREssO project ('Enhancing Synergies for Disaster Prevention in the European Union'). The analysis serves to highlight common themes and issues across EU countries, with relevant insights from the EU and global levels, concerning three central challenges for successful disaster management in the EU: (1) the integration between climate change adaptation (CCA) and disaster risk reduction (DRR); (2) bridging the gap between science and policy; and (3) strengthening transboundary crisis management in the EU. The purpose of the report is to provide input and insights into the final deliverables in the ESPREssO project. This summary briefly outlines the identified issues for each challenge (click on bold and underlined text to go to the relevant section in the report).

Chapter 3 explores the obstacles and ways forward for **the integration between climate change adaptation (CCA) and disaster risk reduction (DRR)** in legislation, policies and institutional arrangements. The following issues were identified:

- Horizontal and vertical coordination issues in CCA and DRR governance persist. Often, the two policy fields are managed by different ministries with little cooperation, and there is furthermore a lack of vertical cooperation between municipalities and national or federal governments.
- In addition, there is an identified lack of capacities of local governments for implementation of CCA and DRR strategies, whereby municipalities and towns lack the necessary competencies and types of expertise needed to be proactive and reshape policies to the local context.
- These issues are of course tied to, and in turn catalyse, resource limitations and poor implementation of strategies. Accordingly, low level of resources and capacities with local public officials is a considerable hindrance to the efforts to integrate CCA and DRR.
- Lack of funding is a general issue in most policy areas. However, the issue is not merely tied to a lack of funds as such, but to the structures that direct funding flows, exemplified by more funds, in some countries, being allocated for CCA than for integrative approaches between CCA and DRR.
- This might in turn be related to different levels and forms of political awareness and risk perception amongst policy and decision makers, especially a lack of awareness of the benefits brought on by further integration between DRR and CCA.
- Raising awareness across institutions and sectors is hindered by inadequate platforms for stakeholder communication and engagement. In part, this is due to the gap between DRR and CCA scientific expert communities and cultures using different terminologies.
- A related point is that unequal attention are paid to CCA and DRR. As climate change has become such an important policy area in recent years, combined with the fact that CCA has been integrated with other policy domains such as urban planning, the added value of "green adaptation" has become an attractive idea for politicians to support and promote.
- Finally, there are conflicting priorities between disaster response and risk reduction. Thus, a recurring issue in disaster management across the world is that more funding and political attention is given to response and preparedness activities and mechanisms which sustains short-term, rather than long-term, thinking.

Chapter 4 address the problems and potentials for **bridging the gap between science and policy** for DRR and CCA, in order to strengthen policy-making, the quality and availability of risk assessments, as well as public awareness of hazards, risks and vulnerabilities. The following issues were identified:

- As is the case for the integration of CCA and DDR, a general issue for this challenge are the inadequate platforms and structures for bringing science closer to policy. Thus, we need to build platforms able to support the translation of knowledge into policy and application, ideally through skilled experts in public institutions working as mediators of science.
- Directly related to this, there is an identified demand for risk expertise in public institutions which can facilitate, and critically use, risk assessments and appropriate new knowledge from scientific institutions and academia. Expertise from private consultancies and NGOs might be a useful resource for filling the gaps, but here it was reported that locating the right kinds of skills among employees is often equally hard.
- Although European states have generally come a long way in terms of making risk tools, there is still an identifiable lack of available risk data on vulnerability. That is, data that does not focus solely on the physical

aspects of hazards, but also concerns the consolidation of, and access to, data across sectors, actors and institutions.

- Although more research than ever before is conducted on disasters and risks, three points are highlighted to illustrate where there is still a limited scope and outlook of research: 1) focus on single hazard rather than multi-hazard approaches; 2) stronger scientific focus on CCA than DRR; and 3) underrepresentation of the social sciences.
- Traditionally, one of the hardest issues to deal with concerns low public awareness of disaster risks and climate change impacts which hinders effective implementation of many strategies, plans and policies at the local and municipal levels. Lack of awareness, even in highly hazard prone areas, still exist in all surveyed countries despite increasing efforts by governments to invest more in risk communication. A related issue concerns the marginal presence of risk and vulnerability in educational institutions.
- A frequently reported issue is that complex scientific terminology hinders effective translation of knowledge from science to policy, as well as from researchers to the public. This is not a question of "dumbing down" science, but rather to find other ways of communicating and explaining complex issues in comprehensible ways.
- Finally, new media landscapes challenge public agencies' emergency communication and the public's trust in online communication, not least on social media. This is coupled with a general lack of engagement with social media by authorities, who often have unclear or no strategies for reaching out to the public via these platforms.

Finally, Chapter 5 concerns the barriers and opportunities for **strengthening transboundary crisis management in the EU**, looking at existing agreements and arrangements between individual countries regionally, and at the EU level generally. The following issues were identified:

- A fundamental issue is a widespread sense of isolated national thinking and lack of political will which hinders the promotion and development transboundary policies, tools and practices. Thus, there is a need to challenge the perception that emergencies can be adequately dealt with without the need for international assistance.
- Although there are a multitude of bilateral and multilateral signed agreements between EU member states for dealing with risks, there is an absence of policies and tools for transboundary crisis management and a lack of legal instruments and concrete policies that can be used by national, regional and local governments in transboundary crisis response.
- An identified issue in several countries is the lack of standardized forms of communication, which also relates to knowledge sharing for DRR and CCA, beyond emergency and crisis communication. The language barrier is mentioned as a central aspect of this issue.
- A further issue relates to international cooperation across national government levels. The lack of clear policies and tools for intra-national emergency management affect international cooperation, in particular when sub-national or sub-federal government entities have to engage in international cooperation.
- On top of the other issues related to DRR and CCA integration, a lack of attention to CCA as a cross-border issue also exists, in particular with regard to interpretation and implementation of policies. This adds an additional level of complexity to international transboundary crisis management, which is further exacerbated if a country has many neighbours, such as Switzerland, Germany or France.
- Finally, conflicting priorities in environmental resources and DRR also affect transboundary cooperation, for instance in the ways in which environmental protection hinders effective flood control in upstream rivers and along coasts. This issue pertains both to the need for bilateral or multi-lateral cooperation between individual countries, as well as to the role of EU policies in individual countries, for instance EU habitat zones imposing restrictions on water course management.

1 Introduction

In the last decade, Europe has experienced a significant rise in disaster losses (EU 2014). Accordingly, the European Union (EU) has developed a number of disaster related mechanisms aimed at improving European disaster response(s), and reducing disaster impacts and risks. However, disaster risks persist. Natural hazards, such as the 2013 European floods, can result in significant loss of lives and major economic impacts. Globally, an estimated 199.2 million people are impacted by natural disasters each year on average (Guha-Sapir et al., 2015), and in 2011 alone the estimated economic value of assets damaged due to natural hazards amounted to 371 billion (USD) (EM DAT, 2016).

Climate change adds additional concern, with the frequency and magnitude of hydro-meteorological disasters projected to increase over the coming decades (IPCC, 2013). Along with climate change-induced extreme weather, increasing urbanization and society's ever-increasing dependence on technology and infrastructure means Europe is more vulnerable to natural hazards than ever. Changes in physical, technological and social systems coupled with recent high-profile mega-disasters, such as the 2017 Atlantic hurricane Irma, are raising global awareness of the need to build the capacity of national governments, civil society organizations and international actors to prevent, respond to and recover from natural disasters (Ferris and Petz, 2013).

In this context, the ESPREssO project aims to address three challenges within the context of disaster management: the integration of climate change adaptation and disaster risk reduction efforts; bridging the gap between science and policy; and strengthening trans-boundary crisis management within the EU.

The purpose of this report is to identify challenges, recommendations and examples of best practice in context of the three ESPREssO challenges. The findings of this report will contribute to the production of recommendations for risk management capability and future research agendas for the European Union in forthcoming ESPREssO outputs. This report provides a comprehensive review of the ESPREssO challenges within six EU member states across the EU and also draws on examples from other parts of the world. In particular, the report draws out issues that were found to span multiple EU member states and those that have been identified internationally. A detailed methodology is presented in Section 2. Section 3 identifies the borders between CCA and DRR practices. Section 4 considers the gap between science and policy. Section 5 addresses the strengthening of transboundary crisis management in the EU and Section 6 summarises the issues that cut across the three challenges, while discussing some possible solutions and ways ahead.

The ESPREssO project:

This report is deliverable 2.2 of the EU H2020-project "Enhancing synergies for disaster prevention in the European Union" (ESPREssO). ESPREssO aims to contribute to a new strategic vision for disaster risk reduction and climate change adaptation, thereby opening new frontiers for research and policy making. The project is coordinated by the Italian research center AMRA (Analysis and Monitoring of Environmental Risk), with the participation of partners from six European states; France, Italy, Germany, Switzerland, the UK, and Denmark.

The final products of ESPREssO are a set of Guidelines, which will identify best practices on risk management capability, and a Vision Paper on future research strategies for the EU, in line with the research priorities following the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030.

Further information can be found online at www.espressoproject.eu.

2 Methodology

This report draws upon the key findings and extractions from a global review, an EU review and six national reports developed for Italy, Germany, France, Switzerland, the United Kingdom (UK) and Denmark. Table 1 provides details of the institutions that led the development of the separate input papers.

Table 1: Lead contributors to the input reports.

Input Papers	Lead Contributors
Italy	AMRA - ANALISI E MONITORAGGIO DEL RISCHIO AMBIENTALE SCARL
Germany	DEUTSCHES KOMITEE KATASTROPHENVORSORGE E.V. HELMHOLTZ ZENTRUM POTSDAM DEUTSCHES GEOFORSCHUNGSZENTRUM
France	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES
Switzerland	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH
United Kingdom	THE UNIVERSITY OF HUDDERSFIELD
Denmark	KOBENHAVNS UNIVERSITET
EU review	KOBENHAVNS UNIVERSITET
Global Review	THE UNIVERSITY OF HUDDERSFIELD

Although each national report was developed and written by individual partners (Table 1), data collection and analysis was coordinated to ensure consistency. Consistency was achieved through regular review meetings and the use of standard protocols and templates. The national reports are based on samples of data collected by respective ESPREssO project partners. Semi-structured interviews were the key data collection tool with additional focus group interviews and a questionnaire survey employed for the global review report. A detailed presentation of the data collection and analysis carried out for each country can be found in the respective national reports.

In addition, a further data collection exercise was conducted with experts that have insight into the global perspective on DRR and CCA, in order to further support the extracted findings from the national, EU and global reports. Semi-structured interviews and focus groups were conducted with 27 global experts in the field. They represented a range of government institutions, international organizations, NGOs, local governing bodies and academic institutions. The collected data were thematically analysed using NVIVO 11 qualitative analysis software (QSR International Ltd., 2017). A detailed description of the data collection and analysis is described in Appendix 01.

3 Challenge one: Integration between climate change adaptation and disaster risk reduction

There is growing recognition that the theory and practice of climate change adaptation (CCA) and disaster risk reduction (DRR) are converging (Solecki et al., 2011). A number of researchers, policy makers and practitioners have identified synergies between CCA and DRR (Sperling and Szekely, 2005, Thomalla et al., 2006, Venton and Trobe, 2008, Mercer, 2010, Birkmann and von Teichman, 2010, Gero et al., 2010). Both CCA and DRR have a mutual aim, to reduce vulnerability and in finding ways of working together both activities will benefit. For example, DRR measures will lessen the impact of extreme events that are becoming more frequent due to climate impact, while CCA measures lessen disaster risk (Lei and Wang, 2014, Venton and Trobe, 2008, Mitchell and van Aalst, 2008). However, the two domains have developed in parallel, and despite clear overlaps, remain independent. To date, there has been much discussion surrounding the topic of integration, but very little research exists on how this can be achieved (Hay, 2012, Gero et al., 2010). While there may be institutional arrangements that suggest some progress with integration at the national policy and institutional levels, the practical reality is that little is happening on the ground at the operational level.

This section discusses key barriers that are preventing successful integration of CCA and DRR and presents examples of best practices and potential ways forward. Key challenges include, horizontal and vertical coordination in CCA and DRR governance structures, weak capacity for implementation at local levels, lack of funding, lack of awareness and risk perception, stakeholder communication and engagement, unequal attention for CCA and DRR and competing priorities.

3.1 Horizontal and vertical coordination issues in CCA and DRR governance

Divergent government structures are widely acknowledged as one of the major challenges in integrating CCA and DRR (Shaw et al., 2010). In many countries, CCA and DRR are managed by different government entities that operate separately. For example, CCA and DRR were found to be managed by different government ministries in Denmark, Germany, Italy, Switzerland and the UK (Lauta et al., 2017, Booth et al., 2017, Amaratunga et al., 2017a, Zuccaro et al., 2017, Marx et al., 2017). In France, although CCA and DRR are managed by the same ministry, they fall under two independent directorates (Ettinger et al., 2017). This is an issue that is not limited to Europe. Studies have identified that CCA and DRR in Australia, Ethiopia, Jordan (UNDP and IUCN, 2012), Nicaragua (Rivera, 2014), Pacific Island Territories (Coppola, 2015) and the USA (Amaratunga et al., 2017b) are managed and governed by separate ministries. However, several Asian countries have demonstrated best practice in combining CCA and DRR into singular government entities. The Philippines have shown the highest level of political confidence by bringing two legislative orders for both domains together. In Sri Lanka, the Department of Meteorology and the Disaster Management Centre are also governed by a single ministry (Amaratunga et al., 2017b).

The development and implementation of two sets of policies by two separate institutions creates several issues. For example, parallel development can result in policies that contradict one another. In Italy, concurring legislation (states/regions) of Civil Protection generated a variety of regional laws that are in conflict (Zuccaro et al., 2017). Furthermore, separate institutions working on similar topics can generate inter-agency rivalries. In Germany competition between agencies has been noted, where agencies vie to retain as much responsibility as possible, ultimately resulting in an unclear distribution of responsibilities (Marx et al., 2017).

Various recommendations have been suggested as ways forward for bringing CCA and DRR government actors together. Analysis of the global data which were collected as a part of the ESPREssO project, suggests that for many countries, there is a need for a 'complete institutional overhaul' and restructuring to bring about political cooperation (see Appendix 01). Alternative ways forward include embedding CCA within DRR (Kelman et al., 2017), or DRR within CCA. It is suggested for the German context that CCA and DRR should not be mechanically integrated at the federal level, but should be jointly integrated into other policy areas (Marx et al., 2017). Adding to this, the German Adaptation Strategy to Climate Change provides an example of the successful application of DRR as a cross-cutting issue within CCA. The Strategy was found to have been successful in initiating cooperation and collaborative initiatives in Germany. This German example can be identified as a potential way forward to integrate CCA and DRR.

Although there is no definite notion on how to bring CCA and DRR government departments together at the national/federal level, there is a clear need for greater communication and coordination, which may help to alleviate

issues such as overlapping or contradicting policies. There also needs to be a greater understanding between departments of their remit, clarification of where they overlap and understanding that they are both aiming for common goals, as highlighted by the Swiss national report (Booth et al., 2017).

At the EU level however, there are strategies and agreements that emphasise the need to have synergies between CCA and DRR, such as the Paris Agreement (COP21) and the EU Floods Directive. The EU Cohesion Policy for example, has as one of its eleven priorities to "promote climate change adaptation, risk prevention and management". The Cohesion policy is the policy behind projects in Member States funded by the European Regional Development Fund (ERDF), the European Social Fund and the Cohesion Fund (European Commission, 2017b).

Looking beyond the EU, Forino et al. (2015) present a conceptual governance framework for CCA and DRR integration in Australia. The study identifies three key domains of CCA/DRR actors, the state domain, the market domain and the social domain. Three arrangements are identified to provide bridges between the three groups. The three bridging arrangements are public-private partnerships (between the state and market actors), private-social partnerships (between the market and social domains) and co-management, to bridge the state and social domains.

Coordination issues are not only present between national level government departments, but also between levels of government (national, regional, local and municipal).

Local governments or municipalities are often responsible for the implementation of DRR and/or CCA activities based on decisions made at the national level. This is the case for Demark, France, Germany, Italy, Switzerland and the UK (Lauta et al., 2017, Booth et al., 2017, Amaratunga et al., 2017a, Zuccaro et al., 2017, Marx et al., 2017, Ettinger et al., 2017) and globally in Canada and Australia (Amaratunga et al., 2017b), to name only a few examples. The disconnect between the central or federal government and local levels, can often result in decisions that may not necessarily reflect local needs. For example, in Switzerland laws are made at the federal level and actions are implemented at the Canton[*] level. In a study of the Swiss context, information transfer from the Federal Government to municipalities was found to occur readily, however, a similar flow of information from municipalities up to Canton and Federal levels was not evident (Booth et al., 2017). As a result, decisions made at the federal level lack proper consideration for the needs and capabilities of the Cantons and municipalities. A similar situation was found in France, where federal decisions are not always applicable to the local level (Ettinger et al., 2017).

Due to fragmentation of local jurisdictions, there can be limited horizontal coordination and a lack of awareness of the actions of parallel authorities. Fragmented local governance has been observed in the UK (Amaratunga et al., 2017a) and local jurisdictions frequently operate in parallel, as seen in the Länder[†] of Germany (Marx et al., 2017) and between Cantons in Switzerland (Booth et al., 2017). Minimal communication between municipalities in Italy has resulted in a limited awareness of the actions of others (Zuccaro et al., 2017).

Global frameworks advocate the need for coordination between government levels. The SFDRR champions the state's role in reducing disaster risk and the sharing of responsibilities with other stakeholders (including local governments and the private sector) (Amaratunga et al., 2017b). One of the main features of the Paris Agreement is its 'bottom-up' structure, focusing on adaptation measures that are country-driven and based upon indigenous and local knowledge (UNFCCC, 2016). None-the-less, it remains clear that implementation based on local knowledge cannot take place without coordination between government levels and effective two-way (bottom-up and top-down) communication.

To ensure policies are suitable for localities in Switzerland, an increase in bottom-up communication from the local level to the federal level and greater participation of local stakeholders in the decision-making process has been recommended. In addition, a central information platform for the sharing of best practices between local jurisdictions would increase knowledge sharing and allow for a more cohesive approach to the integration of CCA and DRR across localities (Booth et al., 2017). There is also a need for different levels to be aware of their role and what they are responsible for. An overall minimization of the national-local disconnect will allow for the goals of international frameworks to be achieved through implementation at the local level.

[*] Cantons are the member states of the Swiss Confederation, of which there are 26.

[†] Länder are the states of the federal republic of Germany, of which there are 16.

3.2 Lack of capacities of local governments for implementation of CCA and DRR strategies

Although local jurisdictions have the responsibility for CCA and DRR, they do not always have the resources, knowledge or ability to manage all principles, policies and practices bestowed upon them, let alone integrate CCA and DRR actions (Nemakonde et al., 2017). This issue was frequently highlighted in the analysis of the six national reports (Amaratunga et al., 2017a, Booth et al., 2017, Ettinger et al., 2017, Lauta et al., 2017, Marx et al., 2017, Zuccaro et al., 2017). In Italy, regional governments have resources available, but their role is predominantly to provide guidelines, while the municipalities, who are responsible for implementation, lack the required resources (Zuccaro et al., 2017). Limited capacity of local governments (including financial limitations) was noted as a barrier to CCA and DRR integration in the UK (Amaratunga et al., 2017a), Germany (Marx et al., 2017), Denmark (Lauta et al., 2017) and France (Ettinger et al., 2017). Local authorities in the UK were found to not prioritize CCA and DRR as they have other more immediate matters that take precedence, for example, economic growth (Amaratunga et al., 2017a). Globally, a lack of local capacity was found in Australia, Canada (Amaratunga et al., 2017b) and South Africa (Ziervogel et al., 2014), where local governments simply do not have the required resources for implementation (this matter is discussed further in Section 3.3).

It is noted in UNISDR (2017) that European countries generally have a good technical capacity for DRR. However, they recommend that city-to-city exchanges would increase technical capacity in regions where it is currently lacking. This would also contribute to providing further horizontal links between localities (as also addressed in section 3.2). Education programmes are one suggested method of increasing local capacity (UNISDR, 2017). Investment from federal governments in capacity and awareness building at the local level would help with the harmonisation of CCA and DRR, as suggested for the German context (Marx et al., 2017). The clear identification of overlaps between CCA and DRR will allow resources to be allocated efficiently and reduce duplication of work, thus reducing strain on local resources. Increased local capacity and local empowerment is key to promoting DRR, and is thus essential for the implementation of the SFDRR (UNISDR, 2017). Promoting local capacity is also in line with the UNISDR campaign 'Making Cities Resilient: Essential 6', which is to "strengthen institutional capacity for resilience" as part of the overall aim of raising the profile of resilience and DRR among local governments worldwide (Amaratunga et al., 2017b).

A related issue is the lack of engagement of the private sector in CCA and DRR programmes and projects (Amaratunga et al., 2017b). One way to relieve the strain on local governments could be to foster engagement of the private sector in CCA and DRR. Private actors often have the financial capacity to make a mark, and in some cases, have taken a leading role in CCA/DRR. Although it must be noted that this may be a result of added business incentive to do so. Insurance companies, for example, have vested interests in natural hazards due to the large volume of insurance claims that may result. In France and Switzerland, insurance companies and reinsurers have been identified as key players in implementing CCA and DRR actions (Ettinger et al., 2017, Booth et al., 2017). In Switzerland, the tourism industry (predominantly the ski industry) is described as an 'agent of change' as they have been the first to feel the impacts of climate change, thus the first to take action (Booth et al., 2017). Encouraging private actors to be involved in CCA and DRR could further positive action while relieving the strain on local government.

3.3 Resource Limitations and Poor Implementation of Strategies

Section 3.2 described the lack of capacities of local governments to implement CCA and DRR strategies. This section looks further at resource limitations as a barrier to CCA and DRR integration in general and also the poor implementation of the identified strategies.

Lack of resources is one of the most significant factors preventing implementation and integration of CCA and DRR actions. Resource limitations are linked to three main areas; human, technical and funding. This section focuses on the lack of capacity in human, technical and other resources which together affect the implementation of CCA and DRR strategies. The funding barrier will be discussed in Section 3.4.

Successful CCA-DRR integration needs to be implemented through actors that have a certain degree of expertise in the field, coupled with proper governance structures (discussed in Section 3.1). Yet, the absence of such expertise hinders processes of integration. In the UK, NGOs, some private sectors and some government entities lack disaster risk experts (Amaratunga et al., 2017a). Zuccaro et al. (2017) highlight that there is a lack of awareness of existing

risks among officials in relevant government bodies and a lack of personnel with sufficient scientific and technological background able to understand the nature of risks, in dealing with CCA and DRR in Italy. Accordingly, Amaratunga et al. (2017a) and Zuccaro et al. (2017) state that this issue is linked with education, funding and resources. This is also a global issue. Based on a study conducted by UNISDR and UNDP (2012), the absence of expertise is one of the key barriers for integration in the Pacific, together with other factors such as lack of co-ordination, communication, political will and insufficient funds (Amaratunga et al., 2017b). In South Africa, a lack of capacity, high turnover of staff within government departments and limited understanding of climate-related issues were all identified as barriers (Ziervogel et al., 2014).

When expertise is available for one subject area (CCA or DRR), it may be lacking in the other, which presents a barrier for integration. For instance, Hinkel et al. (2015) state that the formats in which knowledge on climate change is supplied is not well aligned to current DRR decision making in the French context.

In addition to unequal distribution of expertise between fields, there are also examples of unequal resource distribution between regional levels. The analysis confirms that although countries such as Denmark (Lauta et al., 2017), Italy (Zuccaro et al., 2017) and Germany (Marx et al., 2017) have enough resources, they see uneven allocation of resources among the national, regional and local levels as a major barrier to the integration of CCA and DRR. For instance, Lauta et al. (2017) state that in Denmark, there are significant differences in the ability of municipalities to take action in terms of CCA, depending on their size, budget and allocated resources. Larger municipalities like Copenhagen have, not surprisingly, been more active in implementing CCA plans. A barrier then exists in terms of the national government giving municipalities a flexible mandate on CCA, which is not beneficial for most of the smaller municipalities (Jensen et al., 2016). In addition, the traditional emergency management sector in Denmark is under a lot of pressure after being restructured into larger units, which has prompted emergency response actors to call for more funding and resources to meet the current increase in storm surge and cloud burst events. In Italy, the laws controlling the division of roles between the political levels raise problems, as the regions have resources available, but their role is limited to providing general guidelines, while the municipalities and the provinces are in charge of producing emergency response plans, but do not have adequate resources (Zuccaro et al., 2017).

Adding to this, municipalities in Germany also have difficulties in implementing policies on the ground. Municipalities often do not have sufficient resources to address CCA issues, and even less for bringing together CCA and DRR in a coherent manner (Marx et al., 2017). Many funding programmes ask for a financial contribution from the applicant ("Eigenfinanzierungsanteil"), often amounting to up to 25% of the total costs. Many cities and communities are not able to provide the necessary amount of financial resources. For some agencies, writing a promising application for funding can be a demanding task which requires well-informed, experienced staff members. Agencies who do not have the personnel resources needed for the application may find the process challenging and, at times, disappointing (Marx et al., 2017). Accordingly, it can be understood that lack of expertise, lack of capacity, lack of resources, lack of information and uneven distribution of resources are linked and act together as a barrier for the integration CCA and DRR. Consequently, the following discussion highlights the examples of good practices around the globe addressing the above identified issues.

Rivera (2014) highlights that the creation of coordinated actions between CCA and DRR would avoid the redundancy of efforts and ensure better use of human and financial resources. If the gap still needs to be filled, then further investment in capacity building should be established. Agreeing with this, with reference to the German context, Marx et al. (2017) state that institutionalised and integrated structures dealing with DRR and CCA, especially on state and municipal levels, need to be set up through investment in capacity building and awareness raising at the local level.

Good practices around the globe recommend the possibilities of resource sharing. For instance, in Switzerland, a shared and conscious "whole of society" approach, spanning policy and society to address CCA and DRR, is emerging, with synergies between the two developing as they make advancements via shared resources such as an internationally-connected science programme, shared funding and multi-level cooperation (Booth et al., 2017). Similarly, in Germany, the need for information sharing has been identified. There is a strong need for constant discussion and reconciliation with the administrations under the responsibilities of other government departments as, for instance, questions concerning flood protection or risk management in the context of hazardous facilities, are shared with the departments of environment and/or economy at all administrative levels. Sharing of information acts to prevent duplication of work and contributes to effective use of resources.

Relating this to the international perspective, the 2009 White Paper 'Adapting to climate change: Towards a European framework for action', sets out several measures on adaptation (European Commission, 2009). The overall aim of the EU strategy on adaptation to climate change is to contribute to a more climate-resilient Europe. This means enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels, developing a coherent approach and improving coordination. This includes strategies for information sharing, and ensuring that adaptation considerations are addressed in all relevant EU policies.

In summary, it can be identified that a lack of expertise, capacity, resources, information, competing priorities and uneven distribution of resources act as major barriers to integration of CCA and DRR. Furthermore, in order to overcome these barriers, coordinated actions, collaboration responsibilities and investment in capacity building at the local level, coordination with communities, and information and resource sharing have been identified as recommended future strategies.

3.4 Lack of funding

Funding systems are also a common barrier to CCA and DRR integration and have been identified as a global issue by interview respondents (see Appendix 01). In some cases, there is a lack of funding for CCA/DRR activities. In other cases, a lack of funding may not necessarily be the issue, but the way in which it is appropriated that hinders integration. Commonly, there is greater funding for emergency response over preparedness and risk reduction (examples include the UK, Italy and parts of Asia and Africa; see Appendix 01). According to IFRC (2016), of the total amount of finance allocated to disasters, 65.5% goes on emergency response, while only 12.8% is spent on anticipatory DRR. In addition, funding is often made available for CCA over DRR, as is the case in Denmark (Lauta et al., 2017), Germany (Marx et al., 2017) the UK (Amaratunga et al., 2017a). Preferential funding for CCA may be, in part, linked to political priorities (discussed further in Section 3.5).

Funding for CCA and DRR comes from multiple different streams. In Germany, due to the various funding schemes in existence, there is a lack of awareness of the funding available (Marx et al., 2017). In Switzerland, there is no clear view of public funding flows, as reviews are not made on a regular or systematic basis. As a result, identifying funds and steering them towards priority projects can be difficult (Booth et al., 2017). As funding comes from different places, the ways in which funding can be used may be limited by the scope of interest of the donor organization, or the remit of government-funded programmes (Amaratunga et al., 2017b). This may result in funds not being made available for combined CCA and DRR activities. Countries deficient in funds may be reliant on donor contributions for CCA and DRR. Under the Paris Agreement, developed nations have an obligation to provide funding to developing countries (SPC et al., 2016). Such contributions may be targeted at actions deemed important by the donor and may not always meet the exacting needs of the recipient country, causing difficulties in the implementation of CCA and DRR efforts on the ground.

As Ettinger et al. (2017) highlight for the French context, greater coherency and efficiency of funding mechanisms is needed to bring together funding flows. A clearer picture of available funding, with systematic reporting, would allow for greater visibility and awareness. More flexibility in donor funding allocation and involvement of recipients in the process would ensure donations meet the needs of recipient countries. This is reflected in the Sustainable Development Goals (SDGs) commitment to enhancing the voice and participation of developing countries in international economic decision making (Amaratunga et al., 2017b). Adding to this, Calliari and Mysiak (2013) highlighted the importance of combining all of the funding instruments by enhancing coherence within the post-2015 development agenda.

3.5 Political awareness and risk perception

Political awareness, perceptions and preferential attention for certain DRR or CCA aspects can result in imbalances between CCA and DRR that act to prevent effective integration. In some cases, there is limited awareness of the need to integrate CCA and DRR in the first instance. As one interview respondent noted, in order to tackle CCA and DRR integration "…being aware of the problem is obviously the first step" (Appendix 01). For example, in Italy the introduction of climate change as a policy issue has been relatively recent, therefore, there is little awareness of the need to integrate CCA with DRR (Zuccaro et al., 2017).

In addition, there is often a limited perception of existing disaster risk. In Italy, the assessment of risk is still in its infancy (Zuccaro et al., 2017), while in Germany there is no comprehensive natural hazards risk overview available

(Marx et al., 2017). In Switzerland, there is limited risk perception for new climate risks and a reluctance to perceive these risks as problematic (Booth et al., 2017). Such lack of risk perception hinders the implementation and integration of CCA and DRR, as there is no perception that work needs to be done. However, there are examples of countries attempting to assess existing risks. For example, the UK has the National Risk Register of Civil Emergencies, which is a five-yearly review of potential disasters (Amaratunga et al., 2017a). There are also attempts at the EU level, with the Civil Protection Mechanism (CPM) (ECHO, 2017) requiring member states to submit risk assessments, in an effort to foster a culture of risk prevention (Lauta et al., 2017). Once existing risks have been identified, an acceptable level of risk must then be determined to identify suitable actions for implementation, although in many cases this is also lacking. For example, in Italy, difficulties in determining an acceptable level of risk have been identified (Zuccaro et al., 2017).

The EU Floods Directive (EFD) provides an example of best practice in raising awareness of risk. The EFD required EU member states to undertake comprehensive food risk assessments, produce flood risk maps and to develop flood risk management plans for the identified hazardous zones (European Commission, 2017a). In making countries take action the EFD raised awareness of flood risk. Requiring members to review their risk assessments every six years keeps the issue of flood risk at the forefront of peoples' minds.

In terms of awareness of international frameworks, expert interviews revealed that often, actors were only aware of the framework pertaining to their area of expertise. For example, CCA actors were only aware of the Paris Agreement and could not comment on the SFDRR. In general, there appeared to be greater awareness of the Paris Agreement than for the SFDRR (see Appendix 01). This may be linked with the legally binding nature of the Paris Agreement having led to greater political awareness (Amaratunga et al., 2017b). A lack of reciprocal understanding further contributes to the implementation of joint goals, as there is no awareness of the overlaps. For information on risk perception amongst the general public, see Section 4.5.

3.6 Inadequate platforms for stakeholder communication and engagement

The effective integration of CCA with DRR requires the participation of a wide range of stakeholders: policy makers, private companies, scientists, NGOs, and educators (IPCC, 2012, UNISDR, 2009). Multi-stakeholder and multi-sectoral processes are vital in building common understanding, commitment and consensus (UNISDR, 2009). Within this context, communication between CCA and DRR stakeholders becomes an important issue for sustainable, long-term integration of DRR and CCA. However, there are several issues surrounding CCA/DRR stakeholder communication to be overcome.

Firstly, CCA terminology tends to be more technical or scientific, which cannot, or is more difficult to, translate into simpler language. As a result, it is difficult to communicate at the community level where DRR actions take place. In a similar vein, the DRR and CCA communities focus on different types of data, that cannot be readily combined. For example, the climate change community mainly focuses on data pertaining to the physical climate system and climate projections, while the DRR community mainly focus on social data of risk and vulnerabilities (Amaratunga et al., 2017b).

Another obstacle to successful communication between DRR and CCA communities is the diverse spectrum of the respective communities and their different perceptions. There are many different people involved in DRR and CCA activities, with many not experts in either CCA or DRR. Consequently, different stakeholders define DRR and CCA concepts as per their knowledge spectrum. This has created many diverse terminologies for both DRR and CCA (see also Section 4.6). This leads to the need for a common language or standard definitions at the national levels. The issue pertains not to the availability of global terminologies, which have already been developed by organizations such as the UNISDR, but that some nations are not adopting them. Also, effective communication between the DRR and CCA communities is hindered as a result of their perceptions towards the two disciplines. The CCA community believes that CCA is more advanced and strong, whereas DRR is considered as non-scientific. Therefore, they are not keen to maintain a direct communication with DRR communities as they believe DRR is only something to do with an emergency response but, not for long-term disaster management planning (Amaratunga et al., 2017b).

As (Lauta et al., 2017) highlight, in Denmark, there is a clear need for greater communication between actors, however, there is currently no means for this to take place. There is also no clear notion of whose responsibility it is to coordinate such an effort. Looking at ways forward, for Germany suggest that a central platform for the sharing of best practices would allow CCA and DRR actors to learn from the actions of others (Marx et al., 2017). With regards

to the Swiss context, Booth et al. (2017) note that new ideas and solutions are most often generated at the community level, as local citizens are often the most greatly impacted. Accordingly, a mechanism via which to share local experiences could be particularly valuable in providing novel solutions. However, there must also be a clear notion of who will take responsibility for this coordination (Lauta et al., 2017).

In terms of best practice, in Germany there are several examples of working groups and alliances which exemplify how stakeholders can be brought together. For example, the working group "Klimawandel und Anpassung im Katastrophenschutz" ("climate change and adaptation in disaster protection") brings together a wide range of actors working in DRR (Marx et al., 2017). Another example can be drawn from The Netherlands Delta Programme. The programme aims to protect the Netherlands from flooding, now and in the future and brings together stakeholders from the central government, provincial and municipal authorities, water boards and civil society organisations. The programme explicitly acknowledges itself as a potential model of good practice and is keen to share water management expertise with others (Government of The Netherlands, 2017). In bringing all stakeholder groups together around specific projects, the programme ultimately develops better communication channels between CCA and DRR stakeholders (Amaratunga et al., 2017b). The SFDRR also provides an example of a platform that has been used for CCA and DRR stakeholder communication, and has encouraged CCA/ DRR stakeholders to attend the same conferences, minimising separation between them (Amaratunga et al., 2017b).

3.7 Unequal attention paid to CCA and DRR

Differing perceptions of risk can impact upon the way decisions are made and the way actions are prioritised. The synthesis of national studies revealed that in several countries, CCA receives much greater political attention than DRR. This includes Denmark, Germany and the UK. For example, in Denmark CCA receives greater attention due to Copenhagen's image as a 'green' city, resting on the notion of 'added value' in which benefits for tourism and the economy are central in CCA initiatives (Lauta et al., 2017). Preferential media coverage of climate change and growing popular interest in the issue both contribute to disparities in political attention and funding (Amaratunga et al., 2017b). On the other hand, in Italy, climate change is an issue that has only recently been introduced into the policy arena and has not yet gained traction (Zuccaro et al., 2017). In France, the CCA community is primarily one of research, with operational objectives only recently being introduced (Ettinger et al., 2017). Globally, in Australia and the USA, it was found that CCA receives very little attention due to the political sensitivity of climate change (Amaratunga et al., 2017b).

Although political attention may be given to CCA, this does not always translate to positive CCA actions on the ground, as in some cases it is used as a scapegoat for other developmental challenges (Kelman et al., 2017). Furthermore, in Germany and Denmark, research projects are known to have been framed in terms of climate change so that they are eligible for certain funding schemes (Marx et al., 2017, Lauta et al., 2017). Even if there is political will for CCA and DRR integration, willingness can often be hampered by the existing legal and policy frameworks. For example, political willingness was demonstrated in France by the renewal of the National Adaptation Plan, but a lack of available methodologies for CCA hindered the actioning of this (Ettinger et al., 2017). Schemes such as the EFD, may help to mitigate this problem by holding members accountable for their actions. For example, the EFD monitors how well Member States follow their reporting obligations, and scores them on their actions which encourages members to follow up on their commitments (European Commission, 2017a).

3.8 Conflicting priorities between disaster response and risk reduction

Although CCA in some instances receives greater political attention, in the DRR domain, the focus is often given to emergency response rather than risk reduction activities. In Germany and the UK, the reason for this may be that civil protection is legally binding, whereas other aspects are not (Marx et al., 2017, Amaratunga et al., 2017a). In the UK, key funds are only allocated to emergency response (Amaratunga et al., 2017a). In the global context, it is noted that in the USA funding only becomes available after a disaster has occurred (Amaratunga et al., 2017b). Similar to the UK and Germany, in most of the Asian countries, the focus is on short-term emergency response activities rather than on long term DRR (Amaratunga et al., 2017b).

A disaster often prompts reassessment of existing policies and can be a driver for rethinking regulations and longer-term solutions, as identified in the French national report (Ettinger et al., 2017). However, examples from Germany

indicate that political will and incentives for investments for longer-term solutions decrease over time, as people forget about the impacts a disaster has had (Marx et al., 2017).

There is a clear need for a longer-term vision, rather than merely addressing the immediate issues (Amaratunga et al., 2017b). One method suggested frequently in the primary data is to shift the focus from the notion of separate CCA and DRR practices to a more holistic, long-term notion, such as resilience or sustainable development. There has been a significant increase in the use of the word 'resilience' in the field of CCA, which has resulted in both research and practical platforms working with CCA and DRR together, especially at the city level. Examples of this in action include the UNISDR Making Cities Resilient Campaign and the Rockefeller Foundation 100 Resilient Cities project. However, it has also been suggested that there needs to be incentives for national governments to take a longer-term approach, which is currently lacking (Amaratunga et al., 2017a).

4 Challenge two: Bridging the gap between science and policy

CCA and DRR are vastly complex processes, and rely heavily on knowledge to formulate effective measures (Lauta et al., 2017). Without sufficient or easily comprehendible information, CCA/DRR decisions cannot be made effectively. However, as widely recognized across many different policy fields, it is a continuous and never-ending challenge to make best use of input from researchers and scientists. In addition, too little effort has been made to bridge the gap between knowledge producers (scientists) and knowledge users (policy makers) (Weichselgartner and Kasperson, 2010). Although in recent years the EU has made significant efforts to include science in decision making, there are still several challenges to be overcome.

Firstly, there is a need to bring academics and scientists working in universities or public institutions closer to the policy level, especially in DRR. Secondly, academics and scientists ought to acknowledge that public officials and politicians need to be presented with the most up-to date knowledge in a form that is free from jargon and esoteric language, in order to be better equipped when preparing and discussing policies. This should be at the heart of the way researchers and scientists prepare input for the policy domain, as well as for stakeholders more generally, with due consideration of when and where scientific consultation is needed for policy processes.

Overall, this section highlights that scientific knowledge needs to have a greater impact and use in many different arenas, from risk assessments, to early warning, to public awareness. Closing the science-policy gap concerns not only closer connections between the scientific and policy domains, but also fostering integration in a way that will enable the best type of new knowledge to be channelled in the right directions, which will eventually lead to added value in terms of reducing risks and creating stronger preparedness structures and mechanisms for the populations of Europe and beyond. This includes addressing the issue at multiple scales, across different actors and across multiple scientific disciplines as argued by Pigeon and Weichselgartner (2015).

4.1 Inadequate platforms and structures for bringing science closer to policy

The major issue confronting the integration of science into policy for DRR and CCA is the lack of platforms and structures that enable the transitions and transformations of knowledge between both basic and applied research, and the government institutions that are central for legislation and policy-making. Generally, there is a desire for scientists and researchers working on CCA and DRR related issues to be more included in decision- and policy-making. Conversely, there is also a general recognition of the importance of science and research to inform policy from the side of the policy-makers. In Denmark for instance, there seems to be a recognition that both planners working on CCA-related issues and emergency response officials are becoming more interested in what researchers have to say, exemplified in a growing number of networks and conference events that include both practitioners, university academics and other relevant stakeholders, such as the Water in Cities ('Vand i Byer') network (Lauta et al., 2017).

However, there is also a need for researchers to acknowledge the complexity of the knowledge that exists in these fields, and that public officials need to allocate an enormous amount of resources to condense long reports and scientific findings, in order for them to be understood by local and national politicians. One of the most concrete aspects of this issue is the lack of, and need for more mediating and facilitating actors, institutions or platforms, which enable a more efficient, productive and satisfying transfer of knowledge from the scientific/academic domain to the policy domain. Employees with skills that can act as intermediaries and translators between academia and policy should be a priority, which in France have been called "mediators of science" (Ettinger et al., 2017). In Switzerland, it has been highlighted that research institutions need to be more proactive in facilitating more efficient transfer of research into policy (Booth et al., 2017).

It has also been noted in several contexts that although there are a large and growing number of research projects involved in producing knowledge and facilitating collaboration between multiple stakeholders, there is a need for synthesis and compiling the lessons learned. In Denmark, for instance, there is a need for synthesizing results from research projects, rather than one project taking over from the next one. As one respondent in the study expressed: "there needs to be innovation to challenge the way we have done things and do things differently". A logical way forward to address this issue is to facilitate arenas, events and platforms that allow for collaboration and synthesis of research across university and research institutions (Lauta et al., 2017). Good examples of such arrangements do exist. In Germany, for instance, the DKK (German Climate Consortium) has brought together several scientific

institutions since 2008 to synthetize scientific findings on climate change and has provided joined assessments (Marx et al., 2017). In Switzerland, the recognition of this gap gave rise to the creation of The Mobiliar Lab for Natural Risks in 2013, a private/public partnership hosted at Universität Bern to bridge the interdisciplinary gap between science and application (Booth et al., 2017).

There are also good examples of communication between the academic community and practitioners working in CCA and DRR. For example, many UK universities have collaborations with national level organizations. There are also non-government institutions active in DRR which sponsor PhD students in order to maintain communication links with the scientific community. In addition, the Environment Agency, which is a government level institution in the UK, has strong links and collaborations with many leading universities.

There are several initiatives across the globe that were created to foster collaboration between science and policy. Some of them include the Integrated Research on Disaster Risk Programme, the World Bank's Global Facility for DRR and the Belmont Forum among many others. Despite this, very few of these initiatives have a strong institutional basis and they have varying success rates. For example, the IRDR receives little funding and changes in leading personnel have hampered the programme. One of the pressing needs at this juncture is to push for stronger institutions that will play a bridging role to bring science and policy closer.

At the EU level, one such initiative is the Joint Research Centre (JRC), the European Commission's initiative for science and knowledge. The main tasks of the JRC is to provide scientific advice to EU policy on different subjects. Over the years, greater emphasis has been placed on research into societal safety and security (where CCA and DRR form a large component). In addition, the Disaster Risk Management Knowledge Centre was created at the EU level with the aim of working towards partnerships; innovation and knowledge management. The European Environment Agency (EEA) also play a key role in the provision of information on the environment to those involved in developing, adopting, implementing and evaluating policy and for the public also (European Environment Agency, 2017).

However, there are also indications that science and policy cooperation is often done to given an appearance of integration, while the scientific input is none-the-less not followed further down the line. This is particularly evident when moving outside of the EU (Appendix 01). An interview with an expert from the Philippines sums up the nature of cooperation as the respondent states "…just to make people feel that they are consulting scientists. Like a token. Our policies are based on consultations with these, but it doesn't necessarily mean that they are following, or that they are trying to apply what the scientists are providing them." Likewise, another respondent stated "I think we set up some structures that will more or less address that, but these are not really that institutionalized, meaning that there is not really an office that will specifically look into, monitor, and find out what… how are we complying or performing in terms what is expected of our country in terms of the Sendai framework. I don't think there are the specific resources allocated for that purpose."

While the wish to work towards bringing science and policy closer is acknowledged, this cannot progress without addressing the barriers that hinder such cooperation. They go back to issues of institutional management and addressing clear roles and mandates to facilitate such a dialogue that will influence policy. There is also keen interest among humanitarian organisations to work with science and research more than before. To name one such recent example, the Save-University Partnership for Education Research (SUPER) Initiative created by Save the Children, seeks to build mutually beneficial projects for researchers and local communities across different national contexts. This initiative grants academic experts an opportunity to strengthen their careers by providing access and a platform, while informing and contributing to the evidence base of Save the Children's programmes.

4.2 Demand for risk expertise in public institutions

The issue of risk expertise in public institutions overlaps in significant ways with the previous discussion (Section 4.1). The need for employees with skills and knowhow in risk and vulnerability analysis was identified for several countries, including the UK, France, Denmark and Switzerland (Amaratunga et al., 2017a; Ettinger et al., 2017; Lauta et al., 2017; Booth et al., 2017). The issue, as highlighted in the case of the UK, concerns not only the lack of risk experts in public governance institutions (municipalities and ministries), but also in private companies and NGOs (Amaratunga et al., 2017a). In Switzerland, for example, it was highlighted how practical-based research has found it very difficult to source money for project proposals, prompting the Swiss Federal offices to upgrade their support in this area (Booth et al., 2017). One of the important aspects of this issue is also that there is a gap between academics and practitioners working on similar problems in DRR and CCA, but who are seldom in dialogue. There

has been voiced a need for institutions or actors that could act as “mediators of science” for practitioners, in particular for local authorities and their staff.

A related issue is the role of private consultancies doing risk assessments for government entities at different levels. In the case of Denmark, some government institutions tasked with overseeing policy in relation to flooding are questioning the soundness and quality of reports and assessments conducted by private consultancies: “The role of consultancies, is often also seen to be problematic, because they have different departments that advise on different things” as one municipal officer explained (Lauta et al., 2017). Although private consultancies lift a heavy work load for municipalities, three-way cooperation forms could be developed better, where academics act as validators of reports produced by consultancies.

For France, it has been noted that education and awareness raising is important for building disaster resilience not only in terms of enhancing public risk perceptions, but also to equip practitioners with the skills and know-how to utilize advice from the scientific community (Ettinger et al., 2017). There needs to be an attentiveness to educating, employing and nurturing people with the right kind of skills and knowledge, lest the value of science and research in DRR and CCA will not be anchored in a sustainable manner in policy institutions and legislative bodies.

A related issue regards the transferability of academic research into arenas where practitioners operate. Useful tools and techniques are developed from academic research, but, there is no proper platform to transfer these into practice. For example, in most cases in Asia, new tools and techniques for DRR and CCA are tried and evaluated only for academic research and are not transferred into practice. As a result, when practitioners need to address issues, they have to follow the same old tools and techniques. Similarly, academic research is often done only as pilot projects. Even when pilot projects are carried out in collaboration with practitioners, the results are not often replicated as a part of a process since there is no funding available for this. For example, pilot projects implemented in one part of Thailand were not replicated in other areas of the country (Amaratunga et al., 2017b).

A related but central issue is the need to address gaps in regulation concerning liability and accountability of scientists and policymakers in relation to civil protection and DRR, especially concerning early warnings, risk assessments and building codes. This issue became most clearly visible during and after the L’Aquila earthquake in Central Italy (Zuccaro et al., 2017). Although these issues might appear to be most urgent in the context of earthquakes given the fast onset and damaging character of such events, examples of controversies over liability and accountability in relation to storms, storm surges, and flooding in other parts of Europe testify to the larger relevance of this issue.

4.3 Lack of available risk data on vulnerability

Across the national reports, there is an identifiable need for more sophisticated, accessible and better structured data for risk and vulnerability assessments, considered vital for DRR policies and actions. Furthermore, some countries have reported a lack of assessments at the national, regional and local levels that go beyond looking at hazards towards vulnerability of all kinds. Risk assessments that are based mainly on hazards rather than vulnerabilities, and on damages to material assets rather than on social and psychological forms of vulnerability, are not adequate to address the challenges of future disasters and climate change impacts.

While several good mechanisms and practices have been developed for sharing risk data and communication on risk, these data sources are not widely available to private actors and scientists due to the sensitivity of the information. For Germany, there is a need to make data more available, accessible and complete. This is especially important for disaster loss data. Common guidelines and tools for collecting, storing and communicating risk data to those who need them is currently lacking (Marx et al., 2017). For Italy, risk assessments and preventative actions have progressed slowly. Here, a gap has been identified in terms of the lack of methodologies and tools for building comprehensive and holistic risk assessments that take into account hazards, exposure and vulnerability under one roof (Zuccaro et al., 2017). As vulnerability information is lacking, risk maps are also not present or are inadequate. As a consequence, emergency plans are formulated on hazards rather than on risk, which excludes vulnerability and exposure. In Italy, there is a need for more data availability and reliability, common approaches and methodologies, and more involvement of the scientific community. Obstacles to the implementation of effective DRR and CCA integrated policies lie in the limited political and institutional awareness of the problems. There are substantial challenges in incorporating findings from scientific research and technological innovations into governance and policy, but they still rarely find concrete applications in governance measures.

In France, a need for better standardizations of risk evaluations has also been identified across the different regions of the country (Ettinger et al., 2017). This also includes the availability and scope of what is included, such as risk information from the lowest administrative levels (municipality/commune) not being available on the ONRN ('Observatoire National des Risques Naturels' or 'National Natural Risk Observatory') platform. There also needs to be a better coverage of the risk profiles of key societal institutions. For instance, not all schools and hospitals have been risk evaluated in the sense of providing all the information necessary to integrate them into planning and development decisions. Regional and local levels also need to have regular updated versions of natural hazard and risk evaluations. Finally, there is a need to move beyond focusing solely on damages to material assets, and focus more on the vulnerability of human safety (human indicators).

Access to data was cited as one of the foremost issues in risk assessment from the global survey conducted in 2017 for the ESPREssO project. This problem is further exacerbated by the demarcation of risk and vulnerability data. The two frames of risk vulnerability assessments have been divided based on disciplines or research designs (qualitative and quantitative). For example, risk assessments are primarily technically oriented using risk matrices, while vulnerability assessments may be conducted using the Red Cross methodology of Vulnerability and Capacity Assessments (VCA) toolbox (IFRC, 2007).

Stang and Dimsdale (2017) argue that risk assessments are siloed as "there is no formal cooperative process for EU institutions and member states to work together in pursuing appropriate cooperative responses to identified climate risks". This could perhaps be one of the reasons why risk assessments continue to be based on either qualitative or quantitative methods. This is also reflected in the division between analysing risk and vulnerability.

Finally, Poljansek et al. (2017) identify that CCA and DRR "rely on the availability of robust knowledge and data at all levels. Knowledge and data are key in defining scenarios and projections according to which adaptation measures are developed, in monitoring progress of implementation and in developing innovative instruments/tools to increase resilience". However, within the scientific community there may be many differences. For years, we have debated the definition and scope of disasters and adaptation. To complicate things, different studies may show different results. To provide an example, according to Kundzewicz et al. (2017), flooding impacts have been shown differently in studies over time. This may be due to availability of data or even attribution of events to climate change. Nonetheless, these differences make it complicated for policy makers to draw evidence or follow scientific results closely. They suggest that "discrepancy in flood hazard projections raises caution, especially among decision makers in charge of water resources management, flood risk reduction, and climate change adaptation at regional to local scales. Because it is naïve to expect availability of trustworthy quantitative projections of future flood hazard, in order to reduce flood risk, one should focus attention on mapping of current and future risks and vulnerability hotspots and improve the situation there (ibid:1).

4.4 Limited scope and outlook of research

There are three points relating to the issue of a lack of broad scope in science and research on DRR and CCA: 1) a focus on single hazards rather than a multi-hazard approach; 2) a stronger scientific focus on CCA rather than DRR; and 3) an underrepresentation of the social sciences (in both fields).

Firstly, a focus on single hazards relates both to the limited perspectives of research and the centring on predominantly one type of hazard (floods in Northern Europe, earthquakes in Italy, etc.). While some research on disasters might focus on many different hazards, these studies often have an international outlook. Conversely, research on disaster risks nationally focus on the most severe and pressing types of hazards.

For Denmark, it has been noted that specific hazard types attract more attention than others if these have happened most recently. This is most visible with the overwhelming attention to cloud burst events, foregrounding the need for action on storm surge protection and preparedness, which are potentially more damaging and costly events (Lauta et al., 2017). This, however, is changing at the present moment after several severe storm surge events recently affected Denmark. There needs to be more attention from the scientific community on the connection between DRR and CCA when evaluating single extreme events, which will provide a better knowledge base for both short and long-term planning. Otherwise, responses to disasters will be reactive in nature, and will focus solely on the most recent events.

While all global frameworks suggest a more holistic and multi-hazard approach, it seems much more difficult to achieve. Kappes et al. (2012) identify difficulties in comparing different hazards to be one of the challenges. It may

also be due to the siloed approach within the hazard sciences. Different hazards have varied approaches to risk assessments. Further work needs to be done to put all of this together. Unfortunately, there may be factors of time and funding that may affect this process.

Second, the limited scope of research also concerns the balance between CCA and DRR. In Germany, it has been identified that CCA constitutes a more popular topic for research compared to DRR, with 16 papers for DRR and 38 papers for CCA found under the same criteria (Marx et al., 2017). While there are always pitfalls to such estimates, given the points raised in the section on challenge 1 (Chapter 3), it is clear that the integration of CCA and DRR also needs to be addressed at the level of academic university research and applied research. In the EU context, both academic and policy institutions seem to share and exchange information at the most basic level. To increase the science-policy interface, there is clear need for more joint and collaborative efforts to co-produce knowledge. This is a clear direction that the EU seems to be moving towards with the research programmes (Lauta et al., 2017).

Third, there is an identifiable need for more investments in the social sciences on risk and vulnerability research, as risks are social phenomena. A longstanding issue in DRR practice and policy is the dominance of the hard sciences and quantitative approaches, and the underrepresentation of the social sciences and more qualitative approaches. For instance, a German academic researcher and professor points out that "[natural] scientific approaches influence the assessment of risk, because they place more value on what can be quantified. It is always easier to push quantified aspects through. They are easier to fund, they can be displayed, they are easier to report, etc. While this can be quite productive, risks are social phenomena and can mostly not be evaluated through a technical formula."

The tendency is also visible for CCA. A study on climate research in Denmark from 2009, for instance, highlights that the majority of research lies within the natural sciences (The Ministry of Science Technology and Innovation, 2009). There is a recognition from respondents that there needs to be more social and humanistic perspectives on CCA, and that these also need to be in dialogue with the hard sciences. The scientific knowledge underpinning policy-making and institutional arrangements in DRR should be incorporating both quantitative and qualitative studies, requiring again both natural and social sciences. Research in the past on climate change and vulnerability has largely taken a technocratic approach (Collette, 2016). Although there is a growing literature from a social angle, there is room for much more engagement.

4.5 Low public awareness of disaster risks and climate change impacts

A major issue related to the relationship between science and policy is the lack of public awareness of disaster risks, and also of preparedness for emergency response in relation to early warnings and forecasts. While it is by far not a new insight that public awareness of disaster risk is low or even absent, it was one of the issues raised most consistently and clearly across almost all national country reports.

For the UK, it was found that even though the government organizations communicate to the community, people are reluctant to appreciate them as they have the perception that a disaster is unlikely to happen to them (Amaratunga et al., 2017a). In the case of Denmark (Lauta et al., 2017), several public officials note that a perception that disasters are unlikely to impact oneself is detectable in the public. Public interest in disasters is high when events occur, but dwindle quickly thereafter, and are almost absent in periods when such events do not occur. For Italy (Zuccaro et al., 2017), the results of surveys carried out in risk-prone areas show that in many cases, citizens are not aware of the risks their community is exposed to, and at which level (for instance, on volcanic and seismic risk perception) (Barberi et al., 2008, Crescimbene et al., 2014). In the case of France, a recent survey found that 78% of French people are unaware of what to do in the event that France's national alert system is triggered, and 63% did not know of the risks they were exposed to in their geographical location (Ettinger et al., 2017). Generally, the perception of risk in a territory is strongly related to the hazard occurrence and existing risk culture. It has been observed to be difficult to raise when no event has occurred.

For CCA, especially where it overlaps with natural hazards, there is also a lack of public engagement. For several countries, it has been noted that there are disagreements about the risks (scope, intensity, frequency, etc.) associated with climate change and natural hazards. In Denmark, public engagement projects have been sarcastically framed by several public officials as being "pseudo-participatory" in character (Lauta et al., 2017). There are many hearings and engagements with citizens, but these are often only structured to meet legal requirements. There is a lack of a recognized body amongst local citizens and responsible authorities, that could help organize the resources from civil society, either by incorporating individual citizens, dike associations and homeowners associations into

response plans, or drawing on existing civil society institutions such as sports associations and scouts groups (DEMA, 2017). Recognized NGOs, especially the Red Cross, could have a stronger role to play during emergencies for incorporating citizen volunteers, but this needs to be addressed and recognized by the national and local emergency response authorities.

There are also significant differences in perceptions regarding the impacts of long-term climate change. In the UK some believe that the impact of natural hazards to the economy, infrastructure and residents will be marginal, whereas others argue that the occurrence of extreme weather events will increase and climate effects will be significant (Amaratunga et al., 2017a).

A related issue highlighted in the Italian and UK contexts is the lack of DRR education and awareness in schools and educational institutions (Amaratunga et al., 2017a; Zuccaro et al., 2017). There is general agreement that strategies for including DRR and CCA perspectives in schools should be prioritized. This relates both to raising general public awareness about current and future risks and adaptation options, as well as educating a work force that will have the knowledge and skills to be employed in the CCA and DRR domains (see also Section 4.2). A respondent from the Maldives notes “only those who have formal education understand those things. So, it’s very difficult for us to go and explain what climate change is to, let’s say, a fisherman who has not done formal education”.

Generally, greater efforts for enhancing and qualifying the communication of disasters to the public will foster better understandings and awareness which could be vital for influencing government priorities from the bottom-up. A more systematic, risk-informed approach in EU policies will also help to achieve the objectives of the Sendai Framework for DRR (Lauta et al., 2017).

In a recent study it was found that “54% of European citizens believe that humans play only a partial role or no role in climate change” (Frontiers, 2017). There is therefore still work to do in communicating climate change science to the public. A study conducted in Japan shows how mass media can influence people’s perceptions and awareness to climate change issues. The study revealed that with increasing attention paid by coverage to issues of climate change, it led to an increase in public awareness (Sampei and Aoyagi-Usui, 2009).

4.6 Complex scientific terminology

An issue that has been reported across several countries, and which relates to the previous, is the complexity and incomprehensible terminology and jargon of researchers. This relates both to public dissemination and awareness raising, as well as to the interface between public officials and researchers. It is important to stress that science needs to operate with specific terminologies which enable a precision and inquiry into the phenomena studied. However, improving upon ways that scientists, researchers and academics might develop tools for changing the type of language they use would help their work have more impact. This is not a question of “dumbing down” research, but rather to find new ways of communicating and explaining complex issues in a more comprehensible way.

Interestingly enough, this issue also seems to have implications for the translation of knowledge and insights between CCA and DRR domains. In the UK, it was noted how CCA terminology is more technical and scientific and is rarely translated into simple English. As a result, it is a challenge to effectively communicate CCA messages at the community level of DRR (Amaratunga et al., 2017a).

For Germany, it has been noted that despite the existence of a number of tools and guidelines for communicating messages from science to policy and to the public, the processes of communicating so that they reach the right target groups is still a great challenge (Marx et al., 2017). This is especially pertinent at the municipal level. Additionally, it has been noted for Switzerland that not only is technical and scientific terminology difficult to interpret for non-experts, but also that the visualizations (here referring specifically to synoptic hazard maps) also contain too much complex information which hinders easy interpretation (Booth et al., 2017). For the Swiss case, it was noted that hazard maps are actually one of the areas in which greater synergy between CCA and DRR can be achieved both for equipping policy makers and the public with the best and most up to date knowledge on risks.

The concepts and terminology used in DRR have been derived and defined differently in different languages. In many languages, there is no direct translation to concepts of resilience and vulnerability (Kelman et al. 2015). While the literal problem of language exists, there is also the problem of using concepts differently. All the more, even within scientific disciplines, we see a huge difference in the understanding of disasters which makes it extremely difficult to communicate in one scientific discourse to the policy world. It is also essential to work with the understanding

that there will probably never be one definition and one method of doing this. The complexity of the subject is to take note of these differences and be able to draw as much synergy as possible between various disciplines.

Our understanding of concepts and terminology creates huge problems for the policy world due to ambiguity and less consensus. Many areas of research are contested making it impossible for the policy makers to come to a crisp conclusion. Scientists cannot be the only group that defines and assess risk and global issues, which needs a more holistic approach to the problem (Wesselink et al., 2013). Furthermore, Science and Technology Studies (STS), an interdisciplinary field of studies, shows that "processes are characterized by an interplay of technical, social and economic discourses in ways both multi-scalar and cross-cultural in nature" (Ibid:3). Thus, the language, ambiguity of statements and advice and slower nature of academic communication can hinder effective influence on decision makers. This is of course an issue than pertains to deeper questions about the transfer of knowledge between different domains in general. The problem is thus also one of epistemology, or how science comes to know what it knows, implying that there are no obvious or easy solutions that can be applied in all contexts at all times.

4.7 New media landscapes

One of the most dynamic and rapidly evolving issues related to this challenge is the role of the media, and especially the challenges and opportunities that social media presents. General distrust and scepticism about online information and news impact public agencies' emergency communication. This is coupled with a lack of engagement with social media by authorities, who often have unclear or no plans or strategies for reaching out to the public via social media platforms, and for providing authoritative news in emergencies. People in the UK, for instance, are highly active on social networks and there are several groups who circulate false information on social media. As a result of this, there is a tendency for the public to lose trust in reliable information which is released online, even by relevant government bodies (Amaratunga et al., 2017a).

The opportunities and risks associated with the spread of social media in disaster situations are only now beginning to be studied by researchers. For this reason, there is substantial focus on the issues of the spread of false or fake news during emergencies, as well as on the mobilization of citizens through social media platforms (Alexander 2014).

For Denmark, several respondents from municipalities and national agencies highlighted the issue of social media and citizen-driven initiatives as a challenge that will demand more focus in the future (Lauta et al., 2017). While some municipalities are proactive in attempting to incorporate citizens via the popular social media platforms, for instance Vejle, many, including Copenhagen, are not. As one public official remarked: "The municipality of Copenhagen is not prepared for the social media challenge, where people act on their own initiative. This means that more clear leadership is needed for crisis situations, where both emergency response professionals and political leaders take a more proactive lead."

While dealing with false information and engaging citizens through social media platforms are new and emerging issues, other issues that have been discussed for years are still present. In Switzerland, a worry over how the mass media can over-sensationalize issues, trends and practices was identified (Booth et al., 2017). A media landscape in which sensations and spectacles are in high demand makes some stakeholders wary of engaging with the press, for instance individual businesses and companies with perhaps a financial risk involved in communicating their plans.

A related issue is that the interests of the media are a hindrance for effective awareness raising. For Italy, it was highlighted that there is a need for effective collaboration between decision makers and practitioners in civil protection and the media. A challenge lies in the fact that media actors have to increase their audience for commercial purposes, or to support various political orientations (Zuccaro et al., 2017). In Switzerland, once again, there are concerns over how media corporations sometimes distort climate trends, and might be seen to lend support to short-sighted measures in support of the tourist industry when long-term sustainable solutions might be more suitable (Booth et al., 2017). In line with this, one interview respondent highlights that the mass media may give different coverage or perspectives on climate change and disasters, or sensationalise issues "there are some mass media which really bring attention, but there are other media who don't care too much. Well, I think that usually, particularly the most progressive ones, they of course talk about climate change, probably, they don't completely understand what is climate change and sometimes they are very sensationally or catastrophic, but this is an important part of the game and this is of course a problem for the whole at an international level, not just a national level".

5 Challenge three: Strengthening transboundary crisis management in the EU

Natural disasters have no respect for national borders, with such events frequently having cross-boundary impacts. Recent European transboundary disasters include the 2013 Central Europe flood, that affected Eastern Germany and Hungary, the extreme drought and heatwave that hit several countries in Europe in 2003 and the earthquake that hit the borders between Italy and France in 1995. Collaboration between nation states and relevant actors is essential in managing such events (Parolai et al., 2016).

Presently, within the EU the Civil Protection Mechanism (CPM) aims to provide 'coordinated, effective and efficient response to disasters'. The CMP brings together the response capacity of the EU's 28 member states to provide coordinated assistance during an emergency. Countries worldwide can call upon the CPM during an emergency should their national response capacity become overwhelmed. The EU CPM is operationalised by the Emergency Response Coordination Centre (ERCC) which monitors emergencies and provides a platform to coordinate responses (ECHO, 2017). In November 2017, the European Commission proposed a new mechanism in response to a growing number of extreme events affecting multiple countries at once that have stretched the limits of the EU CPM. The newly proposed 'rescEU' will include a response reserve of civil protection assets, in addition to national capacities (European Commission, 2017c).

The chapter concerns the question of how to enhance and strengthen transboundary crisis management in the EU. The challenge is rather concerned with how to improve regulatory framework, management structures and communication between EU countries for disasters and emergencies within the EU borders. This challenge involves multiple different and complex issues that are hard to address as they have to do with national sovereignty, and the relationships between EU and national policies. The question of governance is highly central to this and the large and increasing number of public and private actors is one of the major complexities in disaster response and risk management (Granot, 1997; Kory, 1998; Katoch, 2006). Although the problem is broader than this and also concerns the fundamental issue of changing perceptions among national governments and emergency agencies to go beyond seeing crisis management solely from a national point of view. But this is a complex issue, evolving as a result of simultaneous processes of centralization and decentralization. As Bossong and Hegemann (2015) have noted, "functional pressures for centralization and trans-nationalization exist alongside deep rooted and potentially conflicting political interests and cultural traditions, not to forget cross-cutting trends towards more decentralized societal resilience." In other words, striking the balance between transnational and localised policy processes that are both trans-national and local in nature, are not fully developed yet within the EU. Importantly, this also has to do with cultural perceptions about international cooperation, as much as it has to with policy development.

At the global level, the recent important frameworks all reiterate and highlight the importance of transboundary cooperation. The SFDRR recognizes the pivotal role of international, regional, sub-regional and transboundary cooperation in supporting the efforts of States, their national and local authorities, as well as communities and businesses, to reduce disaster risk. It highlights that each State has the primary responsibility to prevent and reduce disaster risk, including exploiting international, regional, sub-regional, transboundary and bilateral cooperation. It guides actions at national and local levels, as well as regional and international levels, to foster more efficient planning, create common information systems and exchange good practices and programmes for cooperation and capacity development, in particular to address common and transboundary disaster risks. Similarly, the Paris Agreement advocates global and regional cooperation and views climate change and adaptation in a global dimension. It brings all nations into a common cause to combat climate change and adapt to its effects, with enhanced support to assist developing countries (UNFCCC, 2016). Likewise, within the UN SDGs there is a dedicated goal on revitalizing global partnerships for sustainable development which recognise the transboundary nature of the problem and the importance of transboundary cooperation. Accordingly, this goal highlights the essential role of the partnerships at the global, regional, national and local level (UN, 2015).

The two other ESPREssO challenges (integrating CCA and DRR and the relationship between Science and Policy) are related to this third challenge in a number of ways, as will be apparent in the following descriptions and analyses of the issues. While the focus on transboundary crisis management has an immediate relevance for DRR, there are certain areas in which CCA intersects with DRR to make transboundary issues more complex, such as sea level rise which has global implications. Similarly, sharing knowledge, streamlining risk assessments and implementing similar

early warning principles as described in Chapter 4, has an added complex dimension when dealing with these issues in a transboundary context.

5.1 Isolated national thinking and lack of political will

As a point of departure for the other issues at stake within this challenge, several national reports have noted how a sense of isolated national thinking, coupled with lack of political will and motivation, is a general hindrance for implementing better transboundary policies, tools and practices. This also relates, as noted for several countries, to a perception that the kinds of disasters and emergencies that occur in countries, unless directly situated on borders between countries, can be handled without assistance from neighbouring countries, or from the EU support mechanisms. While most disasters and emergencies within the EU are indeed of a scale manageable to modern industrialized nations, such thinking is nonetheless dangerous in light of future climate change altering existing patterns of hazards. The issue at stake is to challenge the perception by countries that emergencies can be adequately dealt with without the need for international assistance.

For instance, in the UK there is a perception that the country ought to be self-dependent during disaster response, recovery and adaptation, for both DRR and CCA. The UK does not have strong communication links with other nation states internationally, when it comes to transboundary crisis management. This relates mostly to a lack of political attention and interest in transboundary crisis management, owing to the opinion that, as an island, transboundary issues are not a concern. As a result, the UK has no formal procedures to work with neighbouring states to manage them. Ten out of 15 experts interviewed for the UK national report emphasise that there is no political willingness to communicate with other nation states on transboundary crisis (Amaratunga et al., 2017a).

In Germany, there are no laws that specifically address the issue of international disaster assistance at the federal level, although there are a number of existing bilateral agreements (Marx et al., 2017). This specifically applies to situations where Germany itself would be in need of international assistance. This lack of relevant legislation can primarily be explained by the fact that so far there has not been a disaster affecting German territory as a whole that would result in a need for international assistance. It is predominantly the role of the Länder to deal with transboundary issues themselves, with certain Länder having agreements with neighbouring nations, such as between Bavaria and Austria.

When it comes to the question of drawing on support from more than bilateral agreements (i.e. the EU support mechanism) there is a perception that the support of bilateral agreements would be more than sufficient. In France, for instance, it is considered unlikely that a disaster would require extra-European means because France is surrounded by countries that are adequately equipped to deal with disasters likely to befall France. Accordingly, when the French authorities decide to call for international assistance, this will generally involve a request for specific equipment from neighbouring countries (Ettinger et al., 2017).

Efforts should be made in the future to make CCA and DRR integration among and between member states an EU priority. This can only be achieved via a strengthening of international communication and information sharing, as well as clearer policies, guidelines and tools for making better use of transboundary cooperation. This perhaps also means that there needs to be found ways to address the sensitive subject of respecting national sovereignty while doing effective transboundary crisis management. This problem is summed up succinctly by an Asian respondent from the global data (Appendix 01): “The main barrier for more integrated crisis management or transboundary response, to these problems is that the state actually observes this norm of non-interference. So, counties actually kind of respect the sovereignty of another country. And (…) because of that, they actually (…) try to avoid interfering with a country and they also avoid forcing a country, to (…) share, the knowledge that they generate.”

5.2 Absence of policies and tools for transboundary crisis management

As disasters proliferate regionally and focus shifts from post-disaster management to DRR, one of the big questions is how to set up the most effective and useful international structures for transboundary crisis management.

Although there are a multitude of bilateral and multilateral signed agreements between EU member states for dealing with risks, such as storms and floods along the North Sea coast or avalanches and landslides in the Alpine region, there is a lack of legal instruments and concrete policies that can be used by national, regional and local governments to effectively use transboundary aspects for crisis response. This has also been noted as a gap even

when international political agreements between countries (either bilaterally or in mulita-lateral agreements) have been signed and agreed upon. For instance, although the Nordic countries have demonstrated political willingness to strengthen the cooperative and operational capacities of disaster management, no operative outcomes are yet in place. In the Haga Declaration from 2009, the ministers of defence from the Nordic countries declared a willingness to develop, among other things, a common Nordic emergency response unit. However, at the moment no operational results have come out of it (Lauta et al., 2017, Nordic Council, 2010).

Another example is the Rhône river basin, connecting Switzerland and France. There is no institutionalised transboundary management of the river, only sectoral agreements (Bréthaut and Pflieger, 2013). Moreover, there are only a few (or no) actors with an overall view of the river's governance and no regulatory institution at the river basin scale. The management of the Rhône river system is characterised by a highly-fragmented governance system consisting of complex, interconnecting public and private laws. Bi-lateral agreements have existed between different stakeholders for many years, reached by negotiations between key operators, but these negotiations were not necessarily open to all. It therefore became difficult to build a realistic picture of the "state of play". Private law agreements added a complicating factor to transboundary transparency and communication issues in the region, which needed resolving (Booth et al., 2017). Similar issues have been identified for Italy (Zuccaro et al., 2017) in terms of volcanic risks that might have transboundary consequences. For the Italian context, it was noted that the challenge concerns the question of how to build-up common transboundary models and procedures to increase the effectiveness of a coordinated action in the field of the technical management of emergency, safety evaluation and risk prevention.

The French national report notes that one of the main reasons why there is a lack of common procedures and policies for transboundary crisis response and DRR concerns the procedural difference among nations in employing professionals in neighbouring countries, a point raised by the NGO sector (Ettinger et al., 2017).

The EU has in recent years provided a number of different directives and policies aimed at strengthening DRR and CCA in member states, which also includes transboundary mechanisms. According to Boin et al. (2014), the EU has 'modest but promising capacities' in assisting member states during times of disaster. With the 'innumerable linkages between the societies of the EU states that have been created by the integration process in the last sixty years' (Attina, 2013), legal and policy cohesion in terms of DRR is necessary. As Boin et al. (2014) highlights, there has been an increased vulnerability to transboundary disasters within the EU, as 'many of the systems that sustain basic societal functions (…) now reach across European political borders'. EU efforts regarding DRR has increased vastly in the last 15 years. Nonetheless, the framework as a whole faces a number of challenges in balancing the very different needs and governance systems of member states, with an increasing need for a coherent and integrated DRR strategy for Europe. Coordination between different member states and also within the EU to tackle transboundary issues is crucial.

Flood risk management in Central Europe is one case in which identifiable improvements to transboundary cooperation has been enhanced by EU legislation as well as agreed-upon common practices. For the German report, interviewed experts and reviews of the existing literature suggest that flood management on transboundary rivers is a best practice example. Procedural and legal frameworks have substantially improved within the last 15 years, in particular in terms of flood warnings, where clear regulations and agreements are in place in most of the regions. "Large scale, transboundary hydro-meteorological events like the Elbe/Labe floods in 2002 and 2013. Comparison of DRR and CCA capabilities in 2013 vs. 2002 demonstrates substantial progress that has been made on transboundary and transnational exchange of critical information and resources to deal with such disastrous situations" (interview with DWD). Here, the EFD and the Water Framework Directive (WFD) have been highlighted as policies that have had a positive impact. As legal acts, mandatory for EU members, the directives have been crucial steps towards cooperation and joint objective-setting across national borders (Marx et al., 2017).

The EFD and the WFD can be identified as best practices in the EU for effective transboundary crisis management. The EU flood directive aims is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive required Member States to first carry out a preliminary assessment in 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they then needed to draw up flood risk maps by 2013 and to establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU (European Commission, 2017a).

The WFD is 'widely accepted as the most substantial and ambitious piece of European environmental legislation to date' (Voulvoulis et al., 2017). The Directive introduces a new legislative approach to managing and protecting water, based not on national or political boundaries but on natural geographical and hydrological formations: river basins. It also requires coordination of different EU policies, and sets out a precise timetable for action, 2015 was the target date for getting all European waters into good condition. The aim is to reduce risk from pollution in lieu of growing demand, with public participation and river basin management plans as key tools for implementation (ibid). The framework is complemented by other EU legislation regulating specific aspects of water use such as the Groundwater Directive (2006), the Environmental Quality Standards Directive (2008), two Commission Decisions (in 2005 and 2008) on ecological status, establishing a register of almost 1,500 sites included in an inter-calibration exercise to allow for comparison of different countries' standards, and published their results (ibid).

The aim is to bring about a 'fundamental change to water management' (Wilby et al., 2006) by introducing a single system of objectives through the integrated River Basin Management Plans (RBMPs) within specified timeframes. The objectives are to: '(a) prevent further deterioration, protect and enhance the status of aquatic ecosystems and the water needs of terrestrial and wetland ecosystems; (b) promote sustainable water use based on the long-term protection of available water resources; (c) enhance protection and improvement of the aquatic environment; (d) ensure the progressive reduction of pollution of groundwater; and (e) contribute to mitigating the effects of floods and droughts' (Wilby et al., 2006). This framework in turn contributes to the wider CCA and DRR policies in terms of reducing flooding risks, pollution and shifts in ecosystems caused by climate change.

5.3 Lack of standardized forms of communication

A recurring issue across most of the national reports pertains to the lack of standardized forms of communication between official agencies of countries. Importantly, this relates to knowledge sharing beyond emergency and crisis communication. In other words, DRR and CCA implementation across borders is also hindered by standards of communication for exchange of knowledge and coordination of tasks.

For Switzerland, a respondent framed the problem accordingly: "Miscommunication problems may arise between two different political cultures. It was really striking and interesting to see France's priority to find an agreement. On the Swiss side, before talking about the agreements, let's talk about the issues. The pace was different. The Swiss wanted to take their time in considering their options".

For France, the language barrier has been identified as key for this issue, which is particularly problematic when working with nation states for cross-border crisis management. More effort to raise awareness about methods used in neighbouring countries would help to mitigate the language problem by creating awareness among actors of other nations methods ahead of any disastrous event. Efficient cooperation relies on a good knowledge of foreign relief team working techniques, means and methods. Additionally, coordination will become easier when certain working habits are put in place. For the Italian context, it was also highlighted that although the transfer and exchange of best practices and good solutions for transboundary crisis management exists, more is needed (Zuccaro et al., 2017).

A need highlighted for several countries was to enhance communication between countries. One obvious starting point would be to establish clear identifiable contact points for nations and sub-national government levels. Simply increasing communication and awareness between national strategies enhances transboundary cooperative links, in preparation for times when it is perhaps urgently required.

Thus, it seems crucial to develop the links during 'normal' times and test it regularly. Accordingly, incentive for local-level stakeholders to communicate regularly with their cross-border counterpart should be in place. In terms of transboundary knowledge transfer, the research platform, 'Intrapraevent', hosted in Austria, fosters scientific exchange between Swiss scientists and policy-makers at a global level, in researching natural hazards and risk reduction (Booth et al., 2017). Such initiatives might also be considered best practice for establishing a recurring cross-border communication.

5.4 International cooperation across national government levels

A further issue relates to the vertical organization of DRR responsibilities across government entities at different levels and scales. There can indeed be spill-over effects of a lack of clear policies and tools for intra-national emergency management for barriers to inter-national cooperation, when sub-national or sub-federal government

entities have to engage in international cooperation. This issue relates to points that have been already touched upon in the chapters on the other two challenges.

For Germany, it was noted that the vertical cooperation within DRR is complicated by the distinction between civil protection ("Zivilschutz") with administrative responsibility at the federal level, and civil protection with respect to all other kinds of hazards and threats ("Katastrophenschutz") that falls under the responsibility of the federal states. As one academic scholar pointed out, "in other countries with a more centralised system, it is often expected that the BBK ['Bundessamt für Bevölkerungsschutz und Katastrophenhilfe' or 'Federal Office for Civil Protection and Disaster Assistance'] could take the lead in transboundary situations that involve several federal states which is not the case." The ways that this issue is expressed thus depend very much on the governmental system of a country, whether it is a federation or one nation-state. In the German case, it has thus been suggested to restructure legislative and administrative levels and structures that blur the boundaries of responsibility between government levels, which could involve an abolishment of the separation of "Zivilschutz" and "Katastrophenschutz" and the affiliated administrative separation (BBK and DST, 2010).

The German case indicates that the present EU framework is not well suited to differences between Federal and national state actors. This might also open up for a discussion about the discrepancy between larger and smaller countries in the EU with respect to their views and histories of activating the civil protection mechanism, implying that larger countries might have less interest in cross-border issues in general.

For Switzerland, transboundary issues may, of course, not always be across international boundaries, but inter-cantonal issues, differences in decision-making, which can potentially lead to a jigsaw approach to either CCA or DRR. This would ideally also pertain to the question of cooperation with neighbouring countries for emergency response, and also for more long term DRR and CCA aspects that require international negotiations.

5.5 Lack of attention to CCA as a cross-border issue

In addition to having different approaches to response and risk assessments between the member countries, there are also different approaches for CCA between countries. Variations in the way countries interpret and put policies into action adds an additional level of complexity. This is further exacerbated if a country has many neighbours. For instance, Switzerland shares its borders with five other European countries: France, Italy, Liechtenstein, Germany and Austria, all of which approach CCA and DRR in slightly different ways (Booth et al., 2017).

For the Italian context, it was highlighted that The National Climate Change Adaptation Plan does not tackle transboundary aspects of climate change impacts, which needs to be a focus (Zuccaro et al., 2017). It was suggested that the integration of DRR and CCA could be more sustained at EU level to be effectively transferred to the Italian context. The possibility that CCA could be directly dealt with by an agency of the European Commission in charge of transferring results, estimations, predictions to the structure of the member states dealing with DRR, should be considered.

The EU has indeed provided several strategic trajectories in recent years pertaining to CCA. The 2009 White Paper 'Adapting to climate change: Towards a European framework for action', sets out several measures on adaptation (European Commission, 2009). Presently, 15 EU Member States have adopted an adaptation strategy, with others under preparation. Some of the adopted strategies have been followed up by action plans and there has been some progress in integrating adaptation measures into sectoral policies. However, as adaptation is in most cases still at an early stage, with relatively few concrete measures on the ground, monitoring and evaluation is proving to be difficult, particularly as indicators and monitoring methodologies have hardly been developed (ibid).

Alongside this, the 'Integrated Approach' opinion report from February 2017 by the European Commission (Hertell, 2017), highlighted the Commission's need to embed their actions further into global frameworks and 'reinforce its exemplary role as well as to help build the synergies between them' (ibid: 10). The report later highlighted how the official Climate Adaptation Strategy review to be published in 2018, shall better 'reflect on the transboundary aspect of the climate risk management issue' (ibid: 11) emphasizing the significance of the Paris Agreement to the EU strategy.

The need for more focus on the DRR aspects of CCA as transboundary issues is an area in which the EU should look to strengthen its focus and support for member states, also for bilateral cooperation between neighbouring countries in addition to the work being done at the general EU level.

5.6 Conflicting priorities in environmental resources and DRR,

A related issue to that identified in Section 5.5 is that transboundary cooperation is also relevant within the context of environmental resource protection, and specifically how such concerns intersect with concerns over DRR and CCA. This issue pertains both to the need for bilateral or multi-lateral cooperation between individual countries, as well as with the role of EU policies in individual countries. For instance, in Switzerland transboundary communication regarding management of the large Swiss-border alpine lakes, namely Ticino (shared with Italy) and Lake of Geneva (shared with France) is a complex arena where environmental and economic pressures compete, e.g. flood risk management, crises management, use, amenity, and risk mitigation are all issues which span shared borders (Booth et al., 2017). However, divergent interests sometimes emerge in terms of governance issues. One example regards managing lake levels for different purposes, e.g. nuclear power plants in France on the Rhone prioritise a certain flow rate and lake storage capacity that is sometimes at odds with flood defence mitigation measures.

A related issue concerns the obstacles associated with EU regulations and policies over environmental protection and conservation, specifically the use of EU habitat zones. In Denmark EU habitat zones have in a few cases been identified as interfering with the ability of Danish municipalities (Copenhagen and Vejle) to implement effective flood protection measures, both for water streams and coasts. As special regulations govern the ability for local authorities to make changes to water flows in EU habitat zones, the priority of nature conservation strains the ability for making DRR and CCA related actions, although local officials see no inherent conflict in balancing these different concerns.

For France, it was noted how the integration of the watershed management approach and the consideration of natural hazards and risk management strategies in all planning processes relating to land-use and the use of natural resources is vital (Ettinger et al., 2017). Implementation of hazard zone maps in land-use planning and management is a first step in this. This also implies a need for more arenas or platforms that allow for stakeholder interaction and knowledge sharing (see also section 3.6).

For Switzerland and France, the GouvRhône platform performed a successful stakeholder analysis assessing the Rhône's diverging interests, while serving as a platform or "new arena" for Stakeholder communication between Swiss and French authorities (Booth et al., 2017). The GouvRhône provided policy makers with options and practical advice on implementation opinions within the different legal frameworks. Although the project has now concluded, it had tangible success in generating an arena for exchanges between stakeholders, which can be expanded upon. This example shows how environmental resource and land-use considerations can be addressed in relation to DRR and CCA issues through stakeholder engagement.

At the EU level, it should be noted that the area of environmental protection in relation to water has been well received. The WFD is 'widely accepted as the most substantial and ambitious piece of European environmental legislation to date' (Voulvoulis et al., 2017). The Directive introduces a new legislative approach to managing and protecting water, based not on national or political boundaries, but on natural geographical and hydrological formations: river basins. It also requires the coordination of different EU policies, and sets out a precise timetable for action. The aim is to reduce risk from pollution in lieu of growing demand, with public participation and river basin management plans as key tools for implementation (ibid).

6 Concluding perspectives

The aim of this report was to identify various issues relating to the three ESPREssO challenges; the integration of CCA and DRR, bridging the gap between science and policy and the management of transboundary crises.

A number of issues have been identified as obstacles to the integration of DRR and CCA. These range from lack of political will to funding issues. Further, due to insufficient platforms for communication between various stakeholders integration rarely becomes a reality. However, positive stories from across the EU and the world can be seen.

Findings from different nations across the EU and globally show that there is an imbalance in priorities, where climate mitigation and adaptation receive greater attention than DRR. While the aim of the report is not to present a theoretical argument about whether CCA is a subset of DRR or not, it must certainly be noted that issues of DRR need higher priority given the impacts and losses the EU has been facing from various disasters. Furthermore, it is not only an issue of prioritisation between DRR and CCA but also between investments in short term disaster response and long terms risk reduction. These issues need to be addressed in policy level dialogue, as well as in framing operational guidelines on how best to bring together CCA and DRR. Both CCA and DRR have become important issues in policy debates. The year 2015 was pivotal for international arrangements in this field. The SFDRR and the climate change negotiations in Paris have been in the spotlight. However, there are still no concrete evidences of integration and how to go about it in practice.

Disaster management and risk reduction are domains enmeshed in the public sector, thus are also affected by changes in funding, institutional reforms and bureaucratic obstacles, not to mention a reliance on specialized knowledge. Accordingly, technical knowledge as well as science-based inputs are becoming pivotal to successful disaster management. However, a number of issues hinder the effective integration between scientific knowledge and policy making. Without repeating the issues identified above, it seems to be an area in which even a small investment in further coordination and development of a common culture could bring visible benefits. Media landscapes have been changing drastically over the years. There is growing recognition for the need to use social media but also to investigate ways of how social media can be used better for the right communication. It is for both policy and scientific domains to work together to better understand these challenges. Accordingly, scientists should find new ways to communicate their results to non-specialist audiences, by using, for example, quantitative and formal techniques developed in operational research (e.g. cost-benefit analysis in order to evaluate possible mitigation actions). On the other side, decision-makers should improve their capability in order to quickly interpret scientific information and translate this into operational decisions and actions.

Finally, the report identified a number of issues for transboundary crisis management. More and more disasters affect nations beyond their national boundaries. Here, the issue of thinking beyond national boundaries takes prominence along with the need for political will. This calls for political champions to tackle transboundary issues by working towards new tools and policies. Further, as CCA and DRR battle to find their space within a broad range of priorities, CCA has not gathered centre stage as a transboundary issue. As expected, communication continues to be a major challenge across borders, not least due to language issues. Transboundary issues clearly show the need for not only bi-lateral but also multi-lateral policies and discussions within the EU.

The identified issues with regard to the three challenges will be explored further via activities and products of the ESPREssO project. The next set of outputs from the ESPREssO project will present recommendations and solutions to the identified challenges.

7 Input reports

AMARATUNGA, D., HAIGH, R., DIAS, N. & HEMACHANDRA, K. 2017a. Synthesis report of legal, policy and science approaches within the frame of disaster risk reduction (DRR) and climate change adaptation (CCA)-ESPREssO Project, National Report-The United Kingdom http://espressoproject.eu/: University of Huddersfield

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9 Appendix 1: Findings from primary data analysis

Primary data gathered via interviews with CCA and DRR experts have been used to supplement findings from the six European national reports, as discussed in Section 2 ('Methodology') of the main report. In total, 27 individuals were interviewed. Thirteen individuals provided responses via telephone and six face-to-face interviews were conducted. Seven individuals formed three focus groups (two focus groups of two and one group of three). In addition, one respondent provided typed responses via email. Recordings were transcribed and thematic analysis was conducted using NVivo software (QSR International Ltd., 2017). For the thematic analysis, initially three primary nodes were defined (the three ESPREssO challenges) and region sub-nodes (Africa, Americas, Asia, Australasia, Global) were placed under each primary node so that themes within each region could be deduced, as shown in Figure 1.

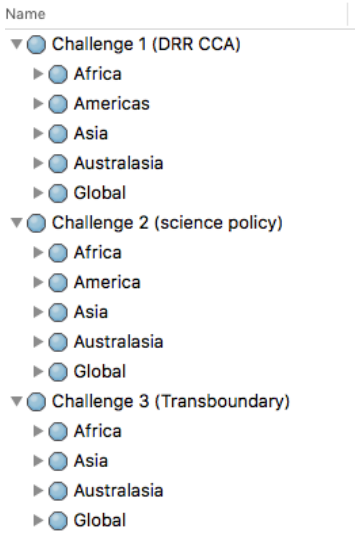

Figure 1 Primary 'Challenge' nodes and regional sub-nodes were pre-defined.

Each interview transcript was then analysed using open-coding, this allowed key themes to be elicited without any pre-assumptions, to ensure new information was not excluded. If a quotation referred to a particular country, this was indicated in the code. If an extract clearly referred to either a challenge or recommendation or an example of best practice, this was also indicated (coded 'challenge', 'recommends' and 'lessons learned' respectively). As themes emerged, new sub-nodes were defined and the open coded material grouped together, as shown in **Errore. L'origine riferimento non è stata trovata.**.

Mind-maps were used to identify key challenges that cut across different countries and regions, indicating the dominant global issues. This methodology was employed for each of the three ESPREssO challenges. Summaries of the findings are presented for each challenge in the following sections.

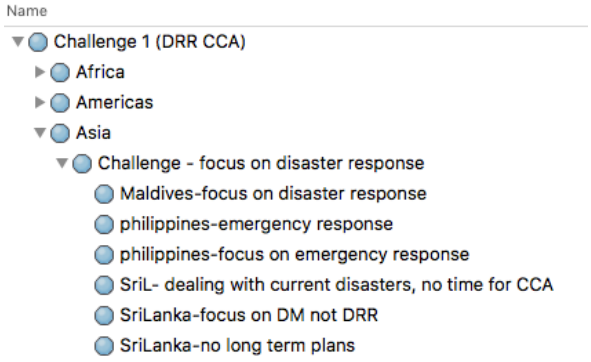

Figure 2 Coding example. Quotations were coded under the relevant ESPREssO challenge and region (in this example, Challenge 1: Asia). A clear theme 'focus on disaster response' emerged among several Asian countries and these extracts were grouped together under a common node ('Challenge – focus on disaster response').

Challenge 1: Integration of DRR and CCA

Figure 3 summarises the findings pertaining to ESPREssO Challenge 1 (integration of CCA and DRR). Governance structures, funding, implementation and awareness were key themes identified during the analysis. These themes were found to be present in multiple countries around the globe.

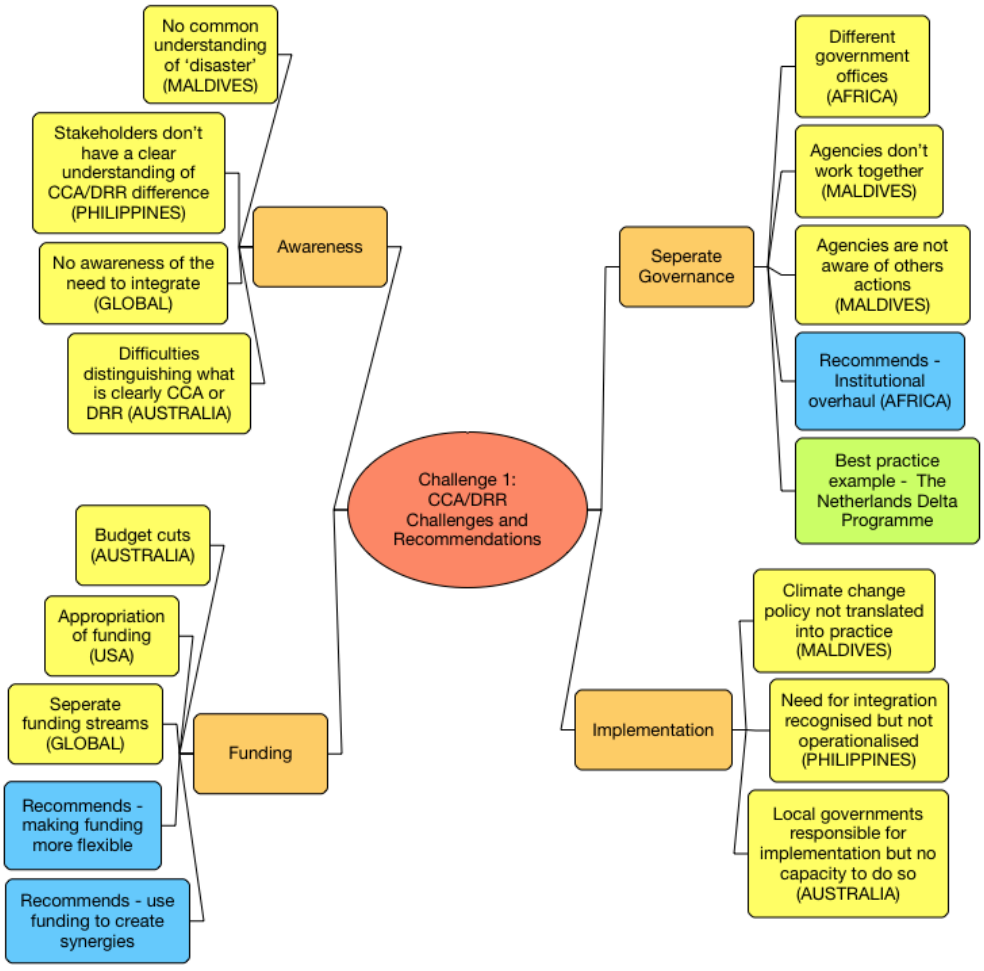

Figure 3 Summary of findings Challenge 1: CCA and DRR Integration.

Interview respondents frequently highlighted the governance of CCA and DRR by separate government departments to be a barrier to integration.

One respondent, an expert in sustainable development in Africa, discussed that in many African nations CCA and DRR are governed separately. In almost all African countries DRR is housed in the Office of the President or Prime Minister, as a result of DRR encompassing terrorism and national security. CCA on the other hand is often located in the Ministry of Environment. The respondent noted that the Office of the President is not a technical place to locate DRR and makes it difficult for the ministries to relate [Global Interview #1].

Some Asian nations also house CCA and DRR in separate government departments. For example, in the Maldives, DRR is managed by the National Disaster Management Centre while CCA falls under the Ministry of Environment and Energy. The two agencies do not work together, resulting in policies that overlap, as one respondent from the Maldives noted:

> *"The agencies don't work together also. They have so many policies and laws that overlap each other as well. The fragmentation is the main challenge."* [Global Interview #9].

Recommendations for ways ahead were also provided. One African respondent suggested that to bring about integration, institutional arrangements need to be overhauled and a multi-sectoral approach is required:

> *"I think that like I mentioned before that there needs to be an institutional overhaul. There needs to be a cross-sectoral approach or to look at disaster risk reduction and to look at climate change issues as a cross-category issue that needs a multi-sectoral approach."* [Global Interview #1].

For the integration of CCA and DRR, one respondent highlighted The Netherlands Delta Programme as an example of best practice. The programme looks to reduce vulnerability and increase resilience of flood prone urban areas in the Netherlands [Global Interview #2]. Further information on the Programme is available online at https://www.government.nl/topics/delta-programme.

Analysis revealed funding to be a key theme. Within funding there are two apparent sub-themes, the first being a lack of funding availability, the second being the way in which funding is allocated.

An example from Australia shows how limited government funding is impacting on CCA-DRR integration. The respondent discussed how the Australian Government is implementing budget cuts across all policy areas. Such budget cuts have resulted in reduced funding for CCA and DRR activities, but has also reduced funding for public health, education and transport, which has acted in increasing the vulnerability of the population. Groups with existing vulnerabilities, such as aboriginal communities, are most affected [Global Interview #5].

In other regions globally, a lack of funding may not necessarily be the problem, but the way in which funds are appropriated that creates a barrier to integration, as suggested by one expert working in Disaster Risk Management in the United States. The respondent noted, along with several others, that there is significantly more funding available for CCA than for DRR. Thus, funding exists but is not evenly distributed. The respondent suggested that the way in which CCA and DRR are spoken of separately has led to donors perceiving them as separate entities and has produced "two separate buckets of money". The respondent suggested that changing the way we speak of CCA and DRR could provide a way forward:

> *"I was just wondering if those with budgets weren't seeing these as two separate things and as more a resilience piece…and that's more the top word or vocab that has been integrated into development and international development and from where I sit, and that's really all-encompassing. So I wonder if perhaps that is a way of solving it. Breaking away somehow from talking about that so there isn't two separate buckets of money, but rather one that is more comprehensive and brings together all the expertise that would be needed."* [Global Interview #14].

This notion was corroborated by another respondent, who indicated that the labelling of funds as CCA or DRR leads to projects being viewed as one or the other:

> *"…when you look at the funding streams, where money is coming from, how is it being dispersed, what tag is it going under, yes? So you have projects that are going under climate change adaptation and you have projects that are going under DRR. So the way in which these funding streams have been tagged when they're being dispersed also affects whether I would look at it as DRR or as a CCA project*." [Global Interview #3].

Respondents from several different countries including Australia, the Maldives and the Philippines stated that DRR and CCA policies often exist on paper but that they are not readily translated into practice. For example, a focus group with two academics from the Maldives indicated that the Ministry of Environment and Energy, which deals with CCA, has a strong climate change department, however their policies are not readily translated into actions [Global Interview #9]. In the Philippines, respondents suggested there was recognition by the government of the need for integration, although the problem they are grappling with is how to operationalise this [Global Interview #12].

A respondent with expertise in Australia linked minimal policy implementation on the ground to a lack of local government capacity. In Australia, local governments are responsible for the implementing CCA and DRR actions, however they do not have the required resources to do so and are not engaged in decision making processes at higher levels of government. In Africa, implementation shortfall was linked to a lack of skilled expertise, where a lack of human resources and skilled expertise in government has resulted in a lack of capacity to implement CCA and DRR actions [Global Interview #1].

Several respondents mentioned a lack of awareness of the need to integrate CCA and DRR as another barrier to integration. As one respondent put it:

> "Being aware of the problem is obviously the first step." [Typed Response #1].

Awareness amongst stakeholders of the difference between the two concepts was indicated by respondents from the Philippines, which creates difficulties in bringing them together [Global Interview #12]. In addition, one respondent from Australia stated it is difficult to define what is clearly CCA and what is clearly DRR [Global Interview #5].

A lack of awareness was also found regarding the international frameworks, the Sendai Framework for Disaster Risk Reduction (SFDRR) and the Paris Agreement. Respondents commonly placed themselves within either the CCA or DRR domain. Often, those working in CCA found it difficult to comment on the SFDRR as they felt they did not have sufficient knowledge, and *vice versa,* with those working in DRR unable to comment on the Paris Agreement. For example, one respondent working in CCA stated:

> *"I mean, I know very little about the Sendai Framework and how it's been implemented so I wouldn't comment on that."* [Global Interview #3].

While one respondent working in DRM was unable to comment on the Paris Agreement:

> *"Don't know, I wouldn't be able to speak of the Paris agreement, I'm not involved in that sphere and policies."* [Global Interview #14].

Another respondent also indicated that the Paris Climate Change Agreement is more dominant in political thinking than the SFDRR globally, and that only those working in DRR are fully aware of The Framework [Global Interview #4]. Another respondent added to this, stating that there is not a good level of consciousness of the SFDRR at city level, where actions are taken [Global Interview #14]. However, no respondent provided a clear indication of how to raise awareness of international frameworks amongst actors.

Challenge 2: Science and Policy

Figure 4 presents the key findings relating to ESPREssO Challenge 2: Science and Policy. Key themes related to political issues, science issues, public awareness and limited access to relevant data. Communication was also a dominant theme, with the influence of the media on public opinions being perceived as a global issue.

Specific issues relating to the policy making process were highlighted by respondents. For example, one respondent from the Philippines indicated that decision makers are not bound to follow scientific evidence and that in some cases, science is only consulted as a token gesture [Global Interview #12]. Decision makers also have other considerations to make such as the economic, political and social impacts of their decisions, which may take precedence. There are also issues pertaining specifically to science. One respondent highlighted that scientists around the globe tend to be poor communicators [Global Interview #3]. The use of complex technical language can also prevent scientific information being taken up by practitioners. This is particularly evident in climate change information which is regarded to be difficult to apply practically in its current format. One respondent suggested that scientific information needs to be put in context for decision makers to add meaning and to make it more relevant for the user [Global Interview #3].

Communication issues were frequently highlighted, not only between scientists and policy makers but also in terms of communicating climate change and disasters to the public. The media play a significant role in communicating information to the public in many countries. However, the media only report on issues for short periods (for example after a disaster) and have a tendency to sensationalise disasters leading to public misconceptions. For example, one respondent noted:

> *"I see some barriers, such as the (very) short-term approach to problems or an excessive sensationalism, i.e. focus on catastrophe and drama (to forget that very same drama the next day…)." [Typed response #1].*

This may be compounded by the fact that the public find climate change information difficult to understand.

Two respondents indicated the use of influencers, such as well-known figures or celebrities may be useful in raising awareness of climate change and natural hazards.

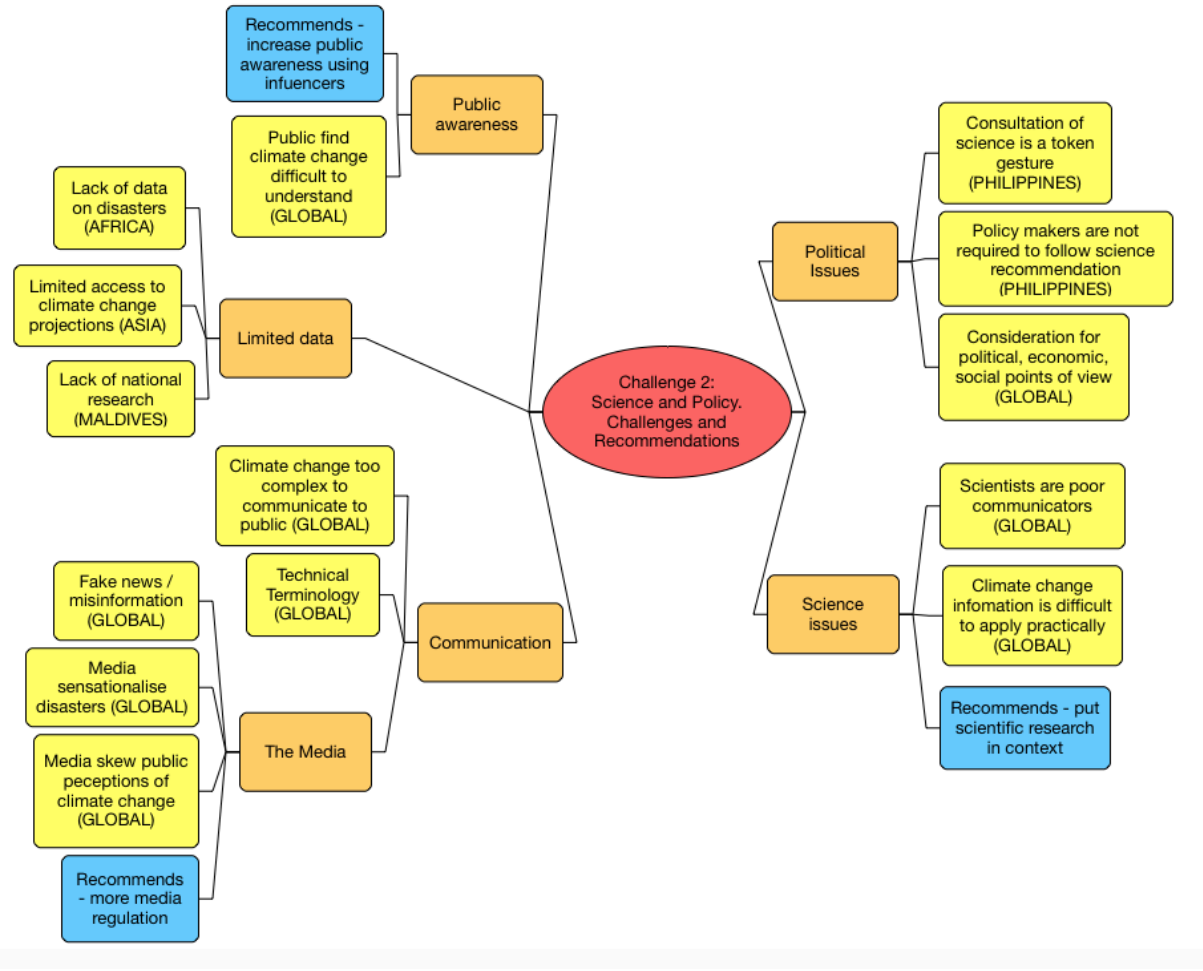

Figure 4: Key findings Challenge 2: Bridging the gap between science and policy.

Challenge 3: Transboundary Crisis Management

Key findings regarding the management of transboundary crises are presented in Figure 5. Key themes include fragmentation of existing transboundary agreements, the predominance of emergency aid agreements, funding and the isolation of some nations.

Respondents from island nations were generally dismissive of trans-boundary issues and suggested that they did not apply to them, as they were an island. Examples include the Philippines, Sri Lanka and the UK. In other cases, continuing historical tensions between countries prevent cooperation. One respondent noted little cooperation between South East Asian countries due to the legacy of the Indochina wars [Global Interview 2]. A culture of respect for other nations sovereignty was also highlighted, leading to bordering nations remaining isolated from one another. As one respondent from the Philippines stated:

> *"People mind their own problems. they don't share them."* [Global Interview #12].

Transboundary agreements in existence tend to be bilateral agreements for post-disaster emergency aid, as one respondent from the Philippines noted. Existing transboundary disaster agreements tend to operate in isolation, with little regard for other agreements and there is no central governance to manage multiple agreements [Global Interview #13].

One respondent provided an example of best practice in Africa. The respondent noted that due to the arbitrary nature of boarders in Africa, transboundary movements of people and activities are much more common, therefore there is a greater awareness of transboundary issues [Global Interview #4]. Countries in east Africa have taken a regional approach to drought management with a regional partnership, the Global Water Partnership East Africa (GWP East Africa) which aims to manage water resources and to tackle climate change in the region. More information on the partnership can be found online at http://www.gwp.org/en/GWP-Eastern-Africa/.

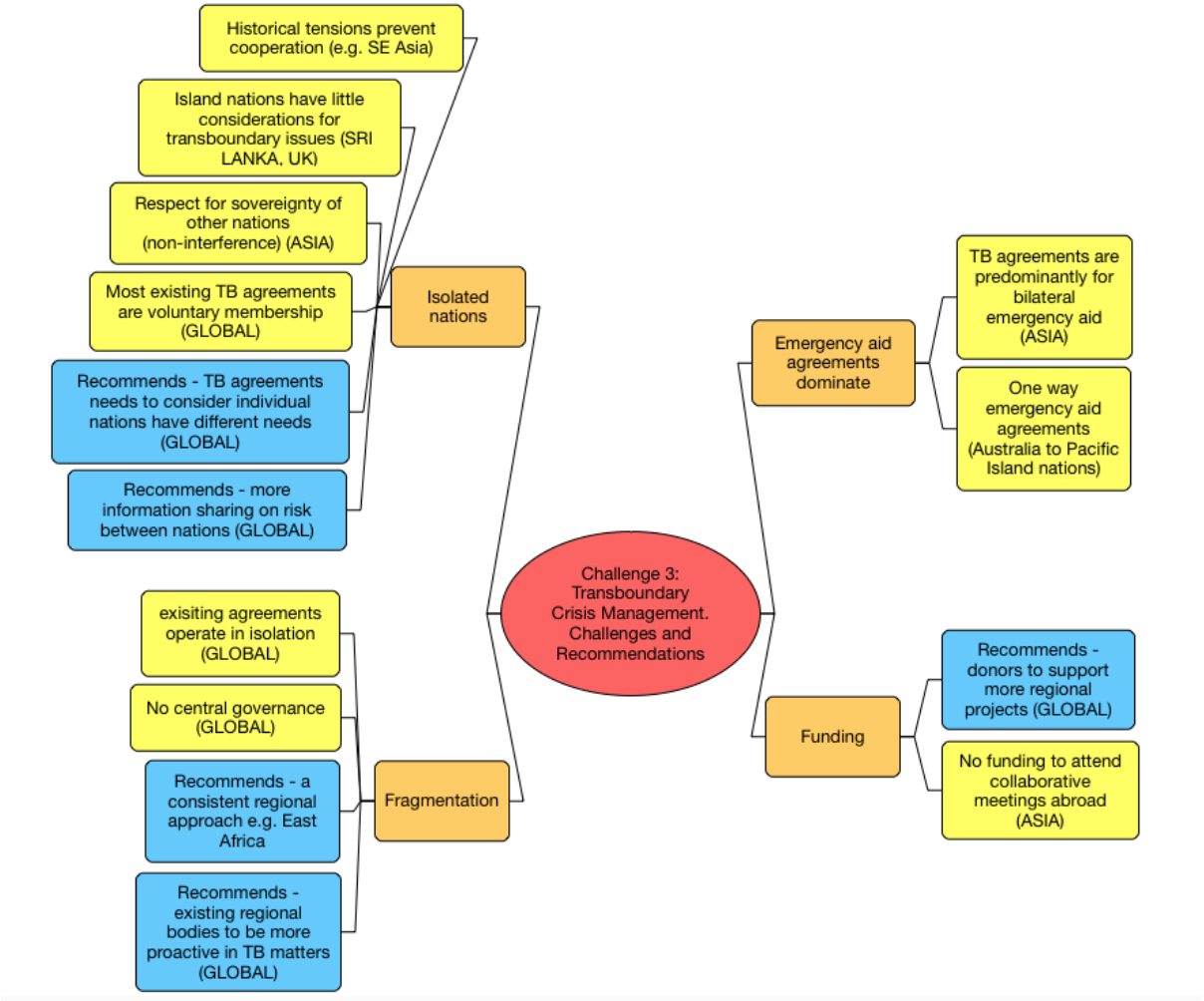

Figure 5 Summary of key findings for ESPREssO Challenge 3: Management of Transboundary Crises.

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